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The Magazine of New Energy Technology

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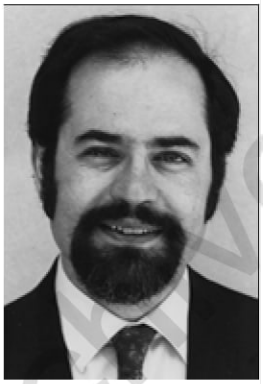
By Eugene F. Mallove, Sc.D.

Cold Fusion: Fire from Water



The tenth anniversary of the cold fusion announcement, March 23, 1999, came and went. Researchers, who years ago helped open a new frontier in science, suffered the predictable slings and arrows from the naysayers and many pseudo-science journalists. Under duress, the work of these scientists and technologists continues.

These are the basic facts of life about cold fusion today, as we see them: A) No increase in the number or quality of peer-reviewed or non-peer-reviewed cold fusion papers will significantly change the forces arrayed against us, and B) The arrival of dozens of widely available commercial prototype units or demonstration devices will quickly turn everything around; this would end the crushing reality of "A," possibly within months of the demonstration units being made available.

We are working to bring about a demonstration kit; one could come at any time, likely from a surprising source. In the meantime, the next best thing we can do is bring "power to the people" by clearing up the false propaganda of the negativists with a concise and portable message that is accessible to hundreds of thousands of people, and then perhaps to millions.

Good news! That message is here. We have completed our landmark science video documentary, *Cold Fusion: Fire from Water*. We could not have done it without the encouragement and support of a benefactor (an *IE* reader) who came to us over a year ago with an urgent request to help make such a documentary. Without his help, this video would not have seen the light of day. The home video version of the VHS tape is about 70-minutes long and it is now available for purchase by consumers worldwide in both NTSC and PAL formats.

Approaches to broadcasting outlets are now underway. We expect to have the broadcast-hour (56 minute) version of *Cold Fusion: Fire from Water* shown nationwide and world wide on select cable networks. We will have more information on broadcasts and showings as it becomes available. (As this issue goes to press, we are excited about the May 26, 1999 Boston-area premier showing of both *Cold Fusion: Fire from Water* and MIT Professor Keith Johnson's cold fusion techno-thriller, *Breaking Symmetry*, in the Grand Ballroom of the Cambridge Marriott Hotel—adjacent to MIT.)

There have been other documentaries about cold fusion before, though not by people associated with the field. Independent journalist Jerry Thompson of the Canadian Broadcasting System (CBC) produced the half-hour program, "The Secret Life of Cold Fusion" in 1993, which never made it beyond the borders of Canada. Then in 1994, Jerry and the CBC teamed up with the BBC to make the 50-minute "Too Close to the Sun," which introduced cold fusion to large audiences in Europe and Canada.

This beautiful production brought the story of cold fusion up to date as of the spring of 1994. Sadly, this documentary was never broadcast in the United States, though it was offered to many broadcast outlets. NOVA, which could have shown it under an existing agreement with the BBC, inexplicably declined to do so. This, even in the face of statements by a senior NOVA staffer to me as early as 1991 that NOVA needed to do an updated cold fusion documentary. (Perhaps they wished to make amends for the disastrous, negative "Confusion in a Jar" program that NOVA broadcast in 1990. NOVA declined to rebroadcast "Confusion" in 1991 after I told its top science advisor that the video was nothing but disinformation.)

I think it is so important that *Cold Fusion: Fire from Water* be shown to family, friends, neighbors, schools, and local journalists, that I make no apologies for our effort to sell the virtues of this video in this editorial space.

No cold fusion video could begin to tell the whole story of cold fusion history and science in 70 minutes. We did not even try; that task may be carried out at some future date. We present the basics of the history. We contrast the scientific attitudes and accomplishments of those who have continued to carry on cold fusion research with the hit-and-run artists, four of whom make their appearance in the program. Above all, we try to explain the basic scientific issues for lay audiences, in a way that has never been done before. We pull no punches: the data overwhelmingly support the existence of profound energy production and nuclear changes in a variety of systems.

Cold Fusion: Fire from Water features twenty-two cold fusion scientists and technologists. Sir Arthur C. Clarke makes three appearances and states, "I've become convinced, from my original skepticism, to 99% certainty that cold fusion is for real. The evidence now is really overwhelming." He makes comparisons with earlier denials of emerging technologies, such as the Wright brothers' flyer from 1903 to 1908.

Star Trek's "Scotty," actor James Doohan, narrates the video, sans his well-known accent. (In the next issue of *Infinite Energy* we will offer some comments by Scotty, er. . .James Doohan, who reflects on his impression of cold fusion before and after his work on this documentary.) Above all, *Cold Fusion: Fire from Water* cites the latest experimental findings and commercial activities, overturning the bogus claim by some journalists and "true-believer" science skeptics that cold fusion is dead.

The video was produced and directed by award-winning Christopher Toussaint of Free Spirit Productions, who offered much well-received editorial advice to scriptwriters and technical advisors Gene Mallove and Jed Rothwell. Unlike Chris's earlier video production, "Free Energy: The Race to Zero Point," *Cold Fusion: Fire from Water* deals exclusively with energy and nuclear phenomena associated with the cold fusion field.

On the video's colorful jacket, we offer a challenge, a message we hope will eventually make its way into many video stores:

> By exploring the history of the discovery and witnessing people working in the field today in laboratories and companies, decide for yourself whether Cold Fusion is one of the greatest discoveries of all time—really a "miracle" in water—or, as the skeptics would have you believe, just a "big mistake."

With the help of our loyal and patient subscribers, the message of this video *will* travel around the world. Many of our

Editorial continued on page 4

New Energy Times Archive

Editorial continued from page 3

dedicated readers may have wondered what these cold fusion scientists and their detractors sounded like in person. Now the opportunity has arrived to see and hear. Go to it!

The cover stories for this issue are a little off the beaten track from our usual fare, although *Infinite Energy* readers have heard before from one of the authors, physicist Dr. Peter Graneau. The commonality of Graneau's article and Dr. Mario Rabinowitz's piece is the power of lightning. Rabinowitz believes that the highly anomalous form of "lightning," known as "ball lightning," is really a manifestation of cosmic "little black holes" that are emitting Hawking radiation as the little black holes "evaporate" their mass through quantum mechanical phenomena. Graneau's contention is that a major part of the energy of thunder, associated with normal discharge lightning, comes from chemical bond energy released in the lightning strike. He also suggests that a heretofore unsuspected magnetohydrodynamic (MHD) power-augmenting effect occurs in this kind of lightning.

Rabinowitz suggests that if we could capture the little black holes responsible for ball lightning we'd have a ready-made genuine "infinite energy" source, though it is difficult to imagine how this could be done. Ball lightning is an exceedingly rare phenomenon. Perhaps we could get some help from science fiction writers who surely have contemplated extracting energy from both big and little black holes.

In the next issue of *Infinite Energy* we'll report on the "Conference on Future Energy" (COFE), which was to be held April 28-May 1, 1999 at the Holiday Inn in Bethesda, Maryland—a little late for coverage in this issue. However, in a related story we do report the sad antics of several pseudoscientists, who mocked cold fusion at the American Physical Society's Centennial Meeting in Atlanta, Georgia in March (see pp. 23-25). Their call for an anti-cold fusion *jihad* occurred at the same time serious cold fusion experiments and data were being discussed by cold fusion scientists down the hall at that same meeting!

One of these bad actors, Dr. Peter Zimmerman, boasted about how he had forced the removal of the COFE meeting from the State Department, where it was originally to have been held. The conference migrated to the Commerce Department after being banned from State, but Zimmerman boasted that he would use his influence to have it banned there as well, and within a few days the meeting was called off at Commerce. It was moved to a Holiday Inn hotel in Bethesda, Maryland, beyond Zimmerman's reach. An investigation of this highly inappropriate activity by Federal employee Zimmerman is now underway, with the help of a sympathetic United States Senator, Bob Smith of New Hampshire.

While ethnic cleansing was apparently underway in Kosovo in the Balkans, pseudoscientists in the U.S. with ties to the U.S. State Department were perpetrating "scientific cleansing" in Washington, DC. These lethal science bigots are trying to do to science what others are doing to human beings—attempting to kill all vestiges of what they consider to be unacceptable. Suppressing "unacceptable" ideas is first cousin to killing "unacceptable" people.

We are comfortable with this comparison of lethality, because in a very real sense by holding back the open and honest consideration of cold fusion science,

Editorial continued on page 34

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LETTERS TO THE EDITOR

To the Editor:

The three papers by Dr. Conte in Issues 23 and 24 and their commentaries by Drs. Santilli and Conte are a sad exchange. There is a perspective to this dialogue which should be shared. Both men make valid points and both need correction.

It is unfortunate that Dr. Conte did not refer to the Borghi work in Issue 23 and did not mention it until the end of the second paper in Issue 24. It is common to mention previous work at the beginning of a technical paper, and even to use a more appropriate title when related to closely associated previous work. A clearer title could have been "New (or "Additional. . ." or "Replicated. . .") Experimental Evidence for the Cold Fusion of Protons and Electrons into Neutrons." The absence of Borghi's reference in Dr. Conte's paper in Issue 23 understandably drew fire from Dr. Santilli, who is sensitive to unethical science, as evidenced in his previous papers in *IE*. Dr. Santilli was too sensitive, as the unfortunate timing of his accusations attest. Dr. Santilli, your vigilance needs more caution, and you should have specific evidence for a specific accusation.

It is understandable to be proud of one's work and to promote it. There is a fine line between pride and bragging. Bragging is evidenced by competition for recognition, as demonstrated by both authors. I, as a reader, find such behavior sickening and unprofessional.

Dr. Conte's terse responses to Dr. Santilli's early communications invited Dr. Santilli's interpretation of hostility. It is common courtesy to respond fully when approached.

I see a lack of cooperation and humility in both parties. If you look for what unites, you find peace and satisfaction. If you look for what divides, you only find the miserable and broken history of humankind. The virtue of humility is best described as a combination of three other virtues: tolerance, gratefulness, and reverence.

Drs. Conte and Santilli, you are intelligent and creative. Find higher expressions of your uniqueness. Balance the vigilance of truth with humility. The end does not justify the means; the end is the means. If you want peace, you must be peaceful. If you want to be trusted, you must be trustworthy. If you want true respect and recognition, you must be respectful and give others recognition.

Kenneth M. Rauen
West Warwick, RI

✍ ✍ ✍

To the Editor:

The handling of the calorimetry experiment at MIT in the spring of 1989 is appalling (see *IE* No. 24). The data of the heavy water cell was processed differently than the light water cell control. The purpose of a control in an experiment is to provide a reference with which to compare the system in question. If the data from the control is processed differently than the system under test, the purpose of the control has been thwarted. Likewise, when the method of processing has not been given in detail, good science has been shortchanged.

I have a Bachelor's of Science degree in chemistry from the University of Detroit. I was taught in a physical chemistry laboratory course to include a complete example of all mathematical calculations, showing all data processing from raw data to finished results for at least one datum point. Along with this exposé of calculations is to be included an estimation of error of the procedures, explaining why the error allowance is what is claimed.

If MIT had followed this prescription for good scientific methodology, there would never have been a protracted debate. If science is desired to be black and white, why not facilitate the process? MIT, if only guilty of a "quick and dirty" experiment, has missed the mark of good science. Since the hasty experiment was never repeated, and certainly without more careful methodology, and a null result (if this truly was null) proves nothing, it is apparent MIT is not interested in the truth. Skeptical scientific inquiry has transformed into political cynicism. A quick, manipulated experiment was enough to convince the MIT PFC that cold fusion was not true, yet after nearly forty years of null results, MIT continues to pursue hot fusion. MIT does not practice pure science. Its' activities are heavily spiked with politics.

Kenneth M. Rauen
West Warwick, RI

✍ ✍ ✍

To the Editor:

In the hydrino atom, stable, non-radiative electron orbits below the Bohr ground state (n = 1) are postulated. The questions arises, then, as to the shrinkage limits of the hydrino. If 1/n were reduced to 1/230, for example, the electron radius of the hydrino would place it within range of the short-range nuclear force, possibly converting the hydrino into a neutron through electron capture. If such is the case, might not the hydrino be the vehicle of the observed CANR ("cold fusion") reactions? If a small number of hydrino atoms were trapped in some isolated region of a palladium lattice, and since such a group of atoms become self-catalyzing after n = 1/2, what would stop their continued devolution short of nuclear (proton) capture. The local release of energy would be very great, as Professor Mizuno's photographs of the cathode surface demonstrate.

Charles Stuart
Titusville, FL

✍ ✍ ✍

To the Editor:

I have just finished reading Dr. Tadahiko Mizuno's book, *Nuclear Transmutation: The Reality of Cold Fusion*. It is fascinating reading; you are to be con-

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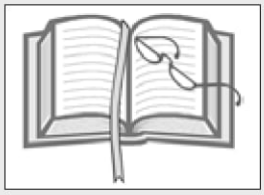

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gratulated for publishing it, and Jed Rothwell for translating it. Dr. Mizuno is clearly an outstanding scientist, a careful and dedicated experimentalist.

Let me make several detailed comments. In Chapter 7, the author states, "Up until now many theories to explain the mechanism of cold fusion have been proposed, but they have been inadequate. First came the ordinary D-D reaction hypothesis. . ." I hope Dr. Mizuno can be persuaded to reconsider the D-D reaction. As Willis Lamb and I showed in 1990, conventional physics could explain the level of fusion processes observed by Steve Jones and colleagues in deuterated metals. Most people think the Coulomb barrier is so high that negligible interaction will occur at low energies. They fail to realize that the barrier to be penetrated by quantum mechanical tunneling is that associated with a pair of electrically neutral composite particles, each particle being a bare deuteron plus an associated screening cloud of conduction electrons. Thanks to Bob Bass, in 1994 I considered the possibility of resonant barrier penetration (See *Infinite Energy* No. 21). This possibility leads directly to: a) the reason for the difficulty in getting reproducible results, b) the presence of helium atoms and excess heat, and c) the very large tritium/neutron ratios. There is also the prediction that there will be helium atoms with a nuclear magnetic moment.

In the Preface, Dr. Mizuno states, "In a few experiments, there were definite signs of neutrons and tritium production, and excess heat was observed. That's not all. It seems the real cause of these effects is not merely nuclear fusion after all. Rather, it is nuclear 'transmutation,' the conversion of heavy elements into other elements, by fission and fusion." Let me suggest that the fusion is what leads to the transmutation. The decay of the helium isomer, resulting from the D-D fusion, leads to an alpha particle moving through the palladium lattice with 24 MeV kinetic energy. This can result in many nuclear interactions producing new elements and isotopes.

In the Forward, you state, "There may be an error in the foundations of physics. Either that or quantum mechanicians will have to do some very fancy footwork to explain what is happening in a provocative variety of cold fusion experiments." I hope my work can persuade you that much of what has been observed is perfectly compatible with conventional quantum mechanics. There is no need to modify or change that most important branch of physics.

Like you, I am disappointed that physicists at MIT refuse to take cold fusion seriously. Fifty years ago when I was a graduate student at MIT, I knew and admired Herman Feshbach. I guess his views are an example of the well-known aphorism: An expert in any field is one who knows what cannot be done.

Robert Parmenter
Tucson, AZ

✍ ✍ ✍

To the Editor:

I greatly enjoyed your exciting article on cold fusion in the July/August 1997 issue of *Analog*, which I just came across. To find such an impressive list of documentation was a most gratifying surprise. The popular press has certainly been amiss in following up on these activities.

Stan Buchholtz
Mystic, CT

✍ ✍ ✍

To the Editor:

I was left with mixed feelings after reading BlackLight Power's recent announcement of having produced an array of hydrino compounds (HHC's): exultation at confirming the reality of the shrunken hydrogen atom (hydrino) and its ability to form a wide range of novel compounds along with the release of energy in their formation; disappointed that BlackLight Power is diluting its energy away from clean power production into areas of greater potential profit but lower social utility. A discovery of this magnitude cannot be controlled by any one country much less any single corporation. (The Wrights' patents did not prevent the Europeans from developing the airplane first.) I cannot imagine any industrial nation without its own supply of oil, or those nations now phasing out their nuclear power plants, not pursuing the development of hydrino power sources at this very moment.

I am probably not alone in wondering whether other light atoms may not be capable of releasing energy by shrinking below their normal ground state. Could it be that the augmented combustion reported in Issue 18 of *Infinite Energy* is due to the lithium atoms, the second lightest element having an odd Z value, shrinking into a lower than ground state in the combustion process?

It is just possible that we are now entering into not just one revolution in physics, but two.

Charles Stuart
Titusville, FL

✍ ✍ ✍

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To the Editor:

Issue No. 23 was superb! Thank you for the effort in creating the Index of all past articles on pages 73-77. I've already found it very helpful.

I was stirred (obvious pun) and inspired by your article on page 30, "Water Stirring Discovery: Is It Connected with Cavitation Excess Energy?" Production of hydrogen and oxygen by stirring the water containing powdered cuprous oxide as catalyst shows the low energy bond-breaking process freeing protons (as H_2) from water. The commonality to sonoluminescence and cavitation phenomena, I believe, is the release of protons from the water. In the case of intense bubbling in water, the formation of swirling chains of plasma protons occurs in the collapsing bubbles (*IE* No. 11, p. 76). These freed protons in the bubble can expand into the bubble wall and weakly capture orbital electrons of nitrogen, oxygen, or argon (creating the flash of light during quantum energy shifts) to form an "unstable momentum," n*, newly termed a "neupron."

In the article in Issue No. 11, I proposed a test of this theory, in which a suspension of bismuth would be added to the water in a cavitation machine such as Jim Griggs', or SL device such as R. Stringham and R. George. If neuprons form, then perhaps bismuth-209 can transmute to radioactive polonium-210, which can be detected by its alpha particle decay:

$$_{83}Bi^{209} + n^* \longrightarrow {}_{84}Po^{210} + e^- + \text{antineutrino}.$$

If the reaction occurs at a worthwhile rate, we can add the industrial process of radionuclide production to the very important development in cold fusion of radwaste reduction.

David Moon
Minneapolis, MN

✍ ✍ ✍

To the Editor:

I wish to express my heartfelt thanks for your dedication to scientific truth and your efforts to inform the world about one of the most important discoveries of all time. If not for your efforts, even before *I.E.*, I would not have been able to mount my in-depth study of the remarkable science. For that I will always be grateful.

I, and many of my fellow science buffs, wish you only the best for the years to come. Thank you for a job well done, and best wishes for the future.

Neil R. McCanney
Tampa, FL

✍ ✍ ✍

To the Editor:

Thanks for the latest *IE*! I really like the path you guys are taking with regard to urging people to quit worrying about anomalies and get on with the business of something that is a reproducible, table-top, proof of principle (PoP) which can be demonstrated and replicated to verify the claim (whatever it might be).

No competent businessman or investor is going to invest in some nebulous experiment with a lot of promises. . . but if they can see it tested, then see it duplicated by someone else AND it can do real work whether it be transmutation, producing power (electricity or heat), or producing some kind of physical motion that could do work or develop power when additional components (generator, etc.) are added. . .now we're talking.

Don Lancaster of Electronics Now has another slam article which will be published in the next month or so; he sent me a prepub, which I'll forward to you.

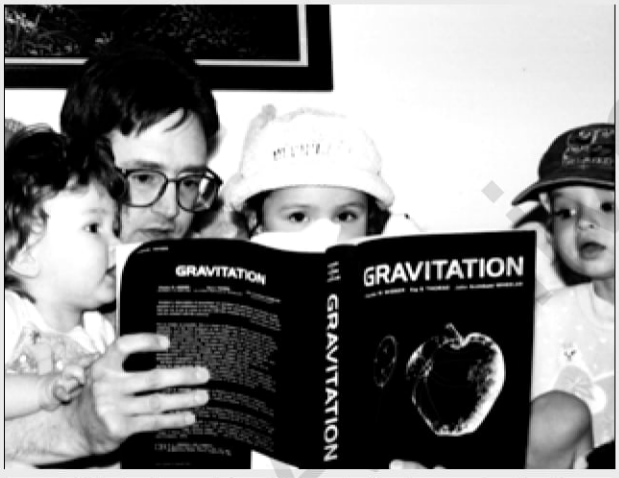
He means well and, like most of us, just wants to cut through the crap and see a working model that any of us can reproduce to verify the principle; he's just a bit more strident about it.

Well, I wanted to let you know I appreciate the issues, even though I'm not a cold fusion proponent per se, I have to agree with John Bockris that the cold fusion experiments indicating transmutation are much more fascinating and potentially rewarding than the anomalous heat production.

I don't mention anything about cold fusion at KeelyNet except the *IE* banner. I figure let people go to the experts and it

Letters continued on page 11

Infinite Energy Magazine Welcomes Associate Editor, Jeffery D. Kooistra.



Jeff introduces his children to "extreme physics."

Jeff is familiar to some of our readers from his work on the Marinov Motor. Indeed, that work, and his writing skills, brought him to the attention of Gene Mallove, though they had met years before in the frontier science forums of Compuserve.

Long interested in both science and science fiction, Jeff published his first science fiction story early in the 90s, and has now had over a dozen stories see print in the pages of *Analog Science Fiction and Fact.* He had recently branched into science writing, and there his life-long passion for science both at, and beyond, the extreme cutting edge, marked him as a natural to replace G. Harry Stine upon his death as one half of Analog's "Alternate View" writing team.

However, it wasn't long after becoming a science fiction writer that Jeff realized he wanted to do science fiction as well as write about it. Although he has a dual major in both physics and psychology, and though he has taught math and physics at both the high school and college level, these traditional sciences, at least as they are handled in Academia, left him bored. The "know-it-all" attitude he found among many of his colleagues he found irreconcilable with the honest pursuit of truth.

He recalls well those days in 1989 when Cold Fusion became a household word. Early on there was tremendous enthusiasm. But then came the lies, and the dishonest dismissals. "It turns out that electrochemists can't do calorimetry," he heard one colleague say.

Fortunately for Jeff, Dr. Thomas E. Phipps, Jr. one day sent along a copy of Wesley's paper on the Marinov Motor, and, to apply a cliché in a place where it applies perfectly, the rest is history.

Although he's now Associate Editor for the magazine, Jeff will be spending most of his time in the laboratory here at Cold Fusion Technology, Inc. He will be assisting Gene and Ed Wall in the evaluation of exciting new energy claims, and will be continuing his work on the Marinov Motor. No doubt because of his background as a teacher, of great importance to him is the putting together of "extreme" physics kits that will help the student and home experimenter to "join in the fun" of wrestling the truth from the clutches of Nature.

As a father with three small children, Jeff and his wife Dorothy are very concerned that the future be a place of infinite promise and energy. He's pretty sure that *Infinite Energy* Magazine is one means to achieving that end. ❐❐❐

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Errata:

It has recently come to our attention that in a past issue of *IE* (No. 8, 1996, pg. 50-57) seven figures from **Dr. Edmund Storms' article "A Study of Those Properties of Palladium That Influence Excess Energy Production by the 'Pons-Fleischmann' Effect"** were in error. We apologize for this previous oversight.—*BDR*

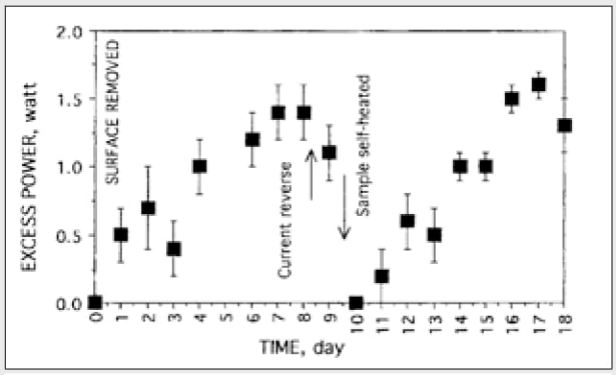

Figure 21. Time history of Sets #1b to #19b after the surface was removed from sample #42.

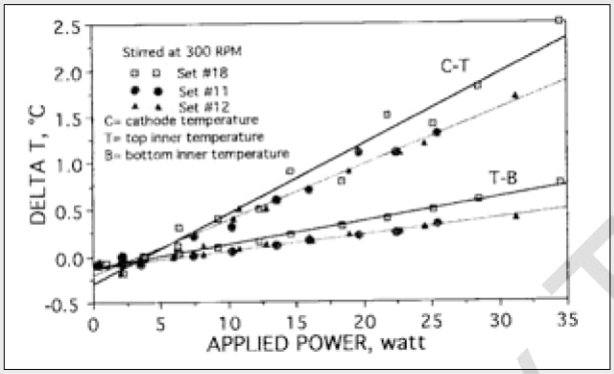

Figure 22. Temperature difference between the cathode and the top of the electrolyte and between the top and the bottom of the anode structure. No excess power was detected during Sets #11 and #12. Excess power was detected during Set #18.

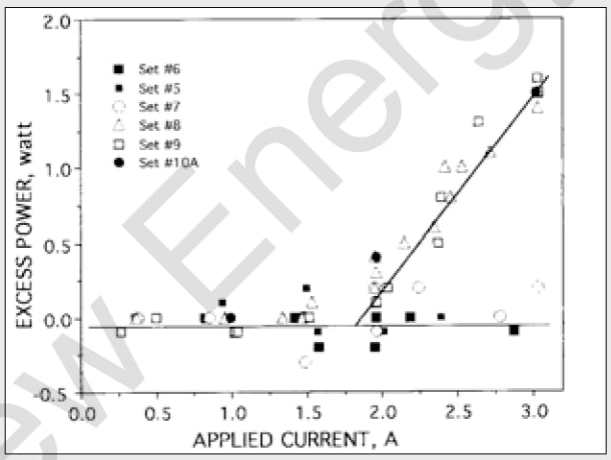

Figure 23. Excess power as a function of applied current for sample #84.

Correction:

In the article **"Rocket Woman: An Interview with Angie Edwards"** (in *IE* No. 23 pg. 61) it was incorrectly stated that Arthur C. Clarke once served as Vice-Chancellor of the International Space University. Sir Arthur is, of course, Chancellor of the ISU and has served in that capacity since 1989. We apologize for this error.—S. Seddon

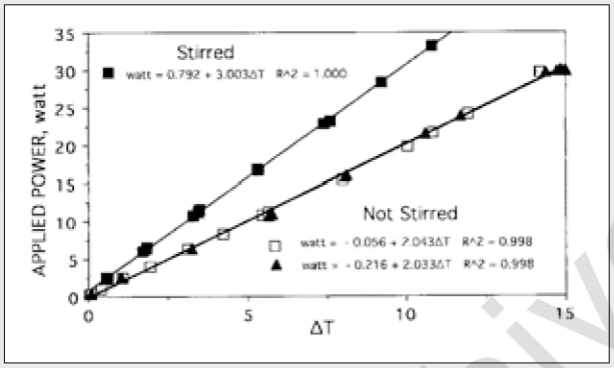

Figure 24. Effect of stirring on the calibration equation for sample #38.

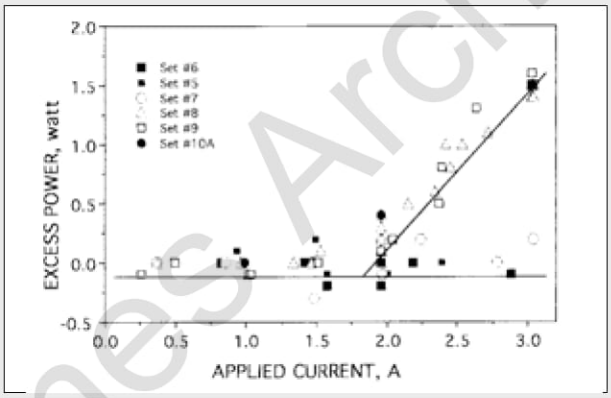

Figure 25. Growth of excess power in sample #38.

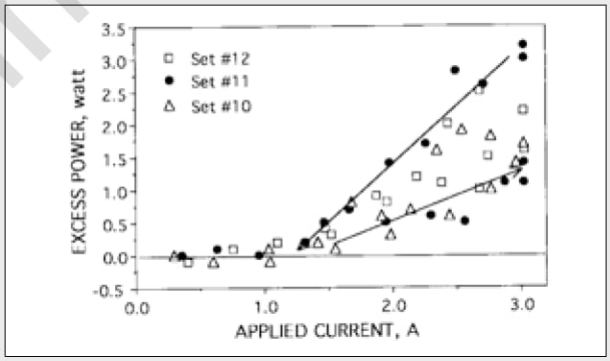

Figure 26. A comparison showing how excess power changed during currrent increase and current decrease during Sets #10, #11 and #12 of sample #38.

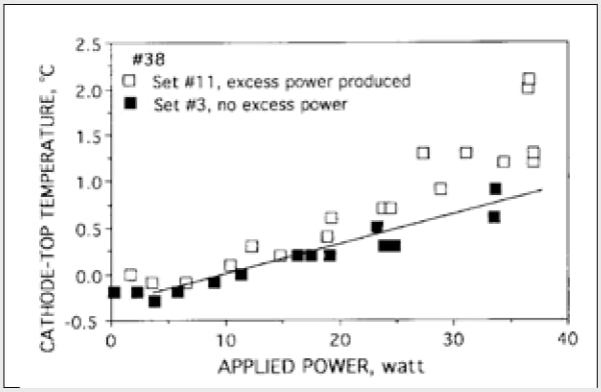

Figure 27. A comparison between the temperature difference between the cathode and the top of the electrolyte while excess power was being made and while it was not.

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WHY DOES LIGHTNING EXPLODE AND GENERATE MHD POWER?

Peter Graneau
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Boston, MA 02115

Presented at *Infinite Energy* Magazine's Cold Fusion and New Energy Symposium on October 11, 1998, Manchester, NH.

Abstract

The talk given at the Manchester symposium reviewed the long history of thunder research and proposed, for the first time, that it is arc liberated chemical energy from the air which explodes the lightning channel. Regardless of the cause of thunder, the ejection of ions from the atmospheric arc through the strong encircling magnetic field should generate MHD (magneto-hydrodynamic) power. This is expected to augment the flow of discharge current in the lightning stroke. Experimental evidence provided by laboratory arcs of lightning strength supports current augmentation by MHD action.

The Cause of Thunder

The best known electric arc in air is the lightning stroke. It explodes and sends a shockwave through the surrounding air, which is known as thunder. Thinking man has observed thunder and lightning for thousands of years. This spectacle plays a role in both Eastern and Western mythology. Thunder is recognized as one of the oldest riddles of recorded scientific inquiry. At the end of the twentieth century we are still questioning what makes the lightning channel explode. Remillard[1] published an excellent review of thunder research from Aristotle to 1960.

In the middle of the present century it was firmly believed, but poorly substantiated, that it was the thermal expansion of the lightning plasma which set up the shockwave in air. Then in 1961 Viemeister[2] published his findings with regard to "cold" and "hot" lightning. He wrote:

> Cold lightning is a lightning flash whose main return stroke is of intense current but of short duration. Hot lightning involves lesser currents but of longer duration. Hot lightning is apt to start fires while cold lightning generally has mechanical or explosive effects.

In the 1980s we proved at MIT[3] with photography and other means that the shockwave emanating from a short air arc of less than one centimeter length and carrying current of lightning strength, between metal electrodes, did not propagate with a spherical front, as it should have if random thermal collisions between air molecules provided the driving force. Instead the explosion was found to be a distinctly radial blast. The expanding air plasma disk, of a thickness equal to the arc length, was ablated by the environmental atmosphere and formed a supersonic edge.

By Viemeister's definition, this was a cold arc. A sheet of newsprint stretched across the arc gap was mechanically torn, but did not catch fire, so long as it did not touch the electrodes, which exhibited surface melting. No charring or any signs of heating could be detected on the paper.

If not heat, what is it that propels the radial arc explosion? The process of gas breakdown and ionization absorbs rather than liberates energy. Arc plasmas are charge neutral and have never exhibited Coulomb force implosions or explosions. Fifteen years ago we thought the forces which drove the arc ions apart had to be of electrodynamic origin, that is they had to be ponderomotive magnetic forces between current elements. Measurements[4] confirmed decisively that the explosion strength increased with arc current in conformity with an electrodynamic explanation.

Unfortunately, according to conventional electromagnetic theory, the dominant electrodynamic force on the arc should be the Lorentz pinch force. This could cause an arc implosion but it acts in the wrong direction for the observed explosion. The Newtonian electrodynamics[4] with Ampere's force law agrees with the Lorentz pinch force but, in addition, predicts strong axial pressure in the arc column. Without a containment tube, the axial pressure will break out in the radial direction. Ten years ago this appeared to be the most likely cause of thunder and air arc explosions.

Intense research of high current arcs at MIT and Northeastern University did, however, reveal that the Ampere forces were too small, by at least a factor of ten, to create the measured arc pressures.[4] This research also involved water arcs in which the explosion pressure was a hundred times that which could be justified with Ampere forces. Then it was discovered that the water arc explosions were the result of the liberation of internal chemical energy.[5] This led to a complete change of the understanding of the dynamics of pulsed arc explosions.

Liberating Chemical Bond Energy with an Electric Arc

All substances owe their existence to chemical bonding. The bonds involve largely electrical forces of attraction and repulsion. In the bonding of any two particles, the attraction must be balanced by nuclear or atomic repulsion, otherwise matter would collapse and fuse. Forces of repulsion are said to store positive potential energy, while forces of attraction store negative potential energy. If negative potential energy were to annihilate positive potential energy, there would exist no stored bond energy, no bonding, and no matter. We are driven to the conclusion that both these energies must be able to exist side by side.

What is known is how much heat it takes to break a bond. This should be—and sometimes is—described as bond dissociation energy. There is no reason to believe that bond dissociation energy must be equal to the stored bond energy. In fact, a given bond may be broken in an electric arc without heating and the dissociation energy is then likely to be very different from the thermal dissociation energy. Bond energy tables actually list thermal dissociation energies. In general, we do not know what the stored potential energies of bonding are.

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Water arc experiments have shown[4,5] that a small amount of electrodynamic energy can unlock a much larger amount of stored intermolecular bond energy, which then causes an explosion. It is not unreasonable to suspect that a similar arc-triggered bond energy release is responsible for the explosion of lightning channels. That lightning and arcs in atmospheric air are responsible for chemical reactions has been known for a long time. In fact, electric arcs are used commercially to convert N_2 and O_2 molecules of air to NO, that is nitric oxide.

A considerable body of knowledge exists regarding the heat required to break up the strongly bonded N_2 molecule, but there exists no information indicating how much potential energy is stored in the molecule. When the N-N bond of the N_2 molecule is deprived of its attraction force by a small electrodynamic force, or action, in the arc, the remaining large repulsion force between the two atoms may instantly drive the atoms apart in an event which could be described as an explosion.

In view of the fact that more than two thousand years of research have not found the cause of thunder, it now looks entirely possible that this cause is the unknown amount of chemical bond energy stored in N_2 and O_2 molecules.

The Exploding Air Arc as an MHD Generator

Ordinary MHD generators, used in military and space applications, employ a rectangular plasma duct of heat resisting dielectric material. This duct is shown in Figure 1. Typically the plasma traveling at high velocity v down the duct is the flame of an oil burner. Electromagnets are usually employed to set up the magnetic flux Φ across the duct which intersects the plasma stream. The ion motion at right angles to the magnetic flux induces the electromotive force (emf) in the direction perpendicular to plasma flow and magnetic field.

As shown in Figure 1, metal electrodes are built into the duct wall so that electrons accelerated by the MHD emf can flow from the electrodes through an external load. This current i represents the electrical energy output of the MHD generator.

In the electric arc, the current creates an encircling magnetic field of considerable strength. Now consider vertical electrodes with an arc gap between them. The magnetic flux circles then lie in horizontal planes. Explosively driven ions, moving radially outward from the arc gap, cross the magnetic flux lines and induce a vertical MHD emf, or the field E_m, in the expanding plasma. Electromagnetic theories are found to demand that the induced emf acts in the direction of arc current flow, as shown by E_m in Figure 2. Hence, the electric arc has to behave like an MHD power generator.

The motionally induced emf in the direction of current flow is a forward emf associated with the conversion of mechanical energy, derived from chemical sources, to electrical energy. The reverse process of the conversion of electrical energy to mechanical energy, as in a motor, produces a back emf. For example, if an electric current is forced to flow through the electrodes of the MHD device of Figure 1 and the plasma is replaced with liquid metal, the apparatus becomes a liquid metal pump, which is the linear motion equivalent of a rotating motor. The motionally induced emf then opposes current flow and therefore is a back emf.

The back emf per unit current has the dimension of a resistance. It adds to the resistance of the current circuit through the electrodes. Similarly, a forward emf per unit current subtracts from the resistance. Hence, we may argue that in the MHD generator the current is increased by a reduction of the internal resistance of the arc plasma.

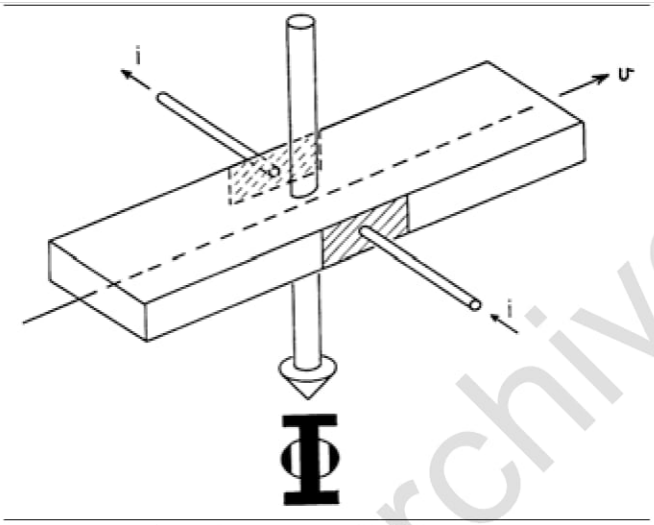

Figure 1. Conventional MHD generator.

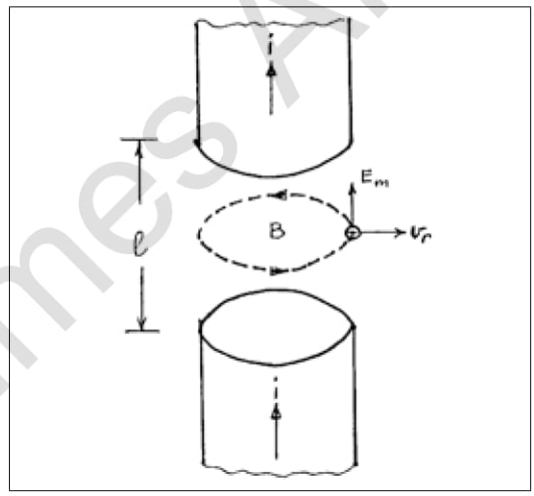

Figure 2. The arc as an MHD generator.

Experimental Indication of the Presence of MHD Energy in an Air Arc

The relevant circuit theory and diagnostics for measuring arc currents, voltages, resistances, impedances, action integrals, etc., are outlined in Reference 4. The air gap between metallic electrode rods is broken down with a capacitor bank charged to a high voltage, usually in the range 10 - 50 kV. The energy stored in the capacitors then drives an oscillating current i through the arc and discharge circuit, which may be written

$$i = I_o e^{-t/T} \sin\omega t, \qquad (1)$$

where I_o is the current intercept of the exponential envelope ($e^{-t/T}$) of the positive and negative peaks, t is time, T the decay time constant and $\omega=2\pi f$ is the ringing frequency. Figure 3 is a typical oscillogram of the decaying arc current.

The solid curve plotted on Figure 4 represents the experimental values of

$$I = I_o e^{-t/T}, \qquad (2)$$

as a function of time. Every positive and the magnitude of every negative current peak lies on this curve.

The MHD power generated has to be very dependent on the current i, which determines not only the strength of the encircling magnetic field B but also the ion velocity v_r as a result of the current-dependent strength of the chemical explosion (see Figure 2). The MHD effect will be zero at t=0 and approximately zero after

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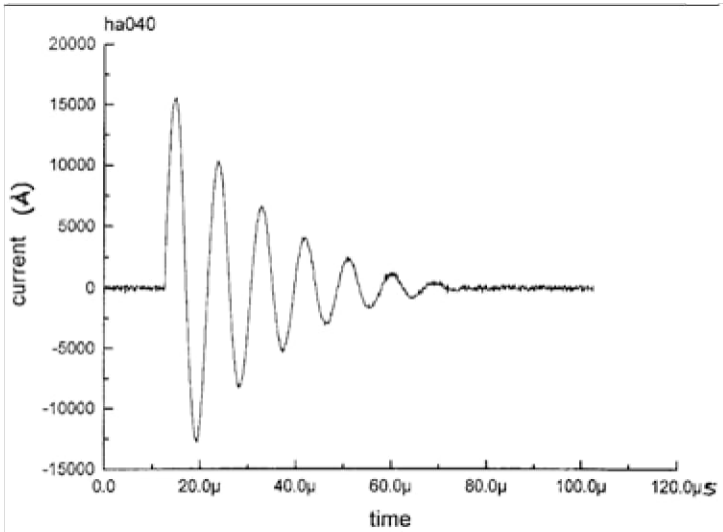

Figure 3. Discharge current oscillogram.

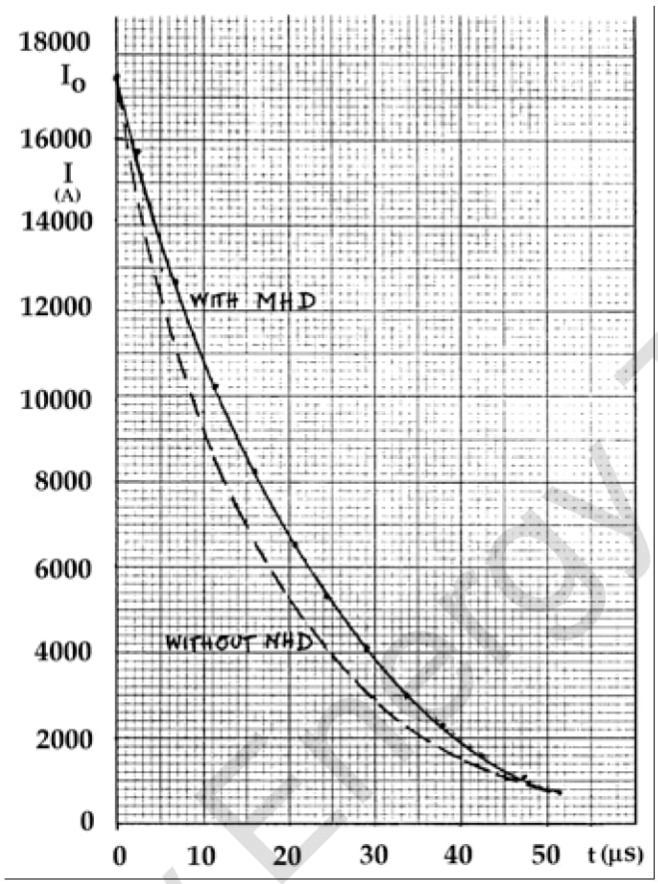

Figure 4. Plot of equation 2.

a certain time when i has fallen below some threshold value.

The solid curve of Figure 4 refers to a particular arc experiment and has been plotted for the positive and negative current peaks of Figure 3. This curve has been labeled "with MHD." From the I_o value and the tail of the curve (I<800 A) the exponential $e^{-t/T}$ can be computed from Equation 2. Using this exponential, the rest of the curve can be plotted. This is the broken curve labeled "without MHD." It is seen to fall below the experimental curve, just as expected if MHD energy is generated over the middle portion of the curve. The difference between the two curves of Figure 4 represents the MHD augmentation of the arc current.

Conclusion

The cause of thunder has eluded scientists from Aristotle on right up to the end of the twentieth century. All explanations advanced in this long search have been disproved with laboratory experiments involving atmospheric air arcs of lightning strength. Now a new explanation has been put on the table. It claims the explosion of the lightning channel is due to the impulsive liberation of chemical bond energy stored in the diatomic molecules of nitrogen and oxygen. It will take time before this suggestion is widely confirmed or rejected.

The lightning channel undoubtedly explodes and thereby shoots air ions through the magnetic field of the lightning current. This should result in the generation of MHD power and an augmentation of the arc current. It now appears that notice of this fact has escaped arc scientists. Maxwell's field theory and the Newtonian electrodynamics agree that the effect should exist, but it remains to be established if it is of significant or negligible magnitude. The first experimental findings suggest that it is significant.

References

1. W.J. Remillard, 1961. "The History of Thunder Research," *Weather*, Vol. 16, p. 245.

2. P.E. Viemeister, 1972. *The Lightning Book*, MIT Press, Cambridge Massachusetts.

3. P. Graneau, 1989. "The Cause of Thunder," *Journal of Physics D: Applied Physics*, Vol. 22, p. 1083.

4. P. Graneau and N. Graneau, 1996. *Newtonian Electrodynamics*, World Scientific, New Jersey.

5. G. Hathaway, P. Graneau and N. Graneau, 1998. "Solar Energy Liberation from Water by Electric Arcs," *Journal of Plasma Physics*, (Cambridge University), Vol. 60, p. 775.

Letters continued from page 7

might add to the subscriptions.

To my mind, at this point, it's a novel chemical battery that takes various forms . . . I do sincerely hope something useful comes out of all this work and energy from so many, much of what I attribute to your amazing fortitude dealing with all these blasphemous unbelievers.

This is a very heartening turn of events and one I hope all of the alternative science community will follow, that is, seeking a prototype that clearly demonstrates the claimed effect, followed by independent replications, inevitably followed by investors smelling a chance to make some big bucks on a relatively small investment

Jerry W. Decker
Dallas, TX

✍ ✍ ✍

To the Editor:

Thanks, very much, for your generous Fed/Ex package. Your publications are superb! I am very impressed with the way you organize and present information.

In particular, I appreciate the way you and your colleagues are focused on asking the right questions. It is, in my humble view, exactly what our present situation calls for.

I will look forward to receiving my subscription to *Infinite Energy* and will look for ways to mention your good work in future reports I hope to write.

Please do keep me informed. And thank you. You are providing a service of incalculable value.

Hal Plotkin
San Francisco, CA

✍ ✍ ✍

To the Editor:

Thank you for the complimentary copy of your magazine. For some time I have been interested in cold fusion, though I know little about it.

I will circulate the magazine at our Annual General Meeting on Friday, February 19 in Hobart. I will also seek the opinion of persons more knowledgeable than I about the concepts.

Fred Thornett, Secretary
Australian Skeptics in
Tasmania, Inc. Tasmania, Australia

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Beamed Black Hole Radiation: Cosmology and Ball Lightning Connected

Mario Rabinowitz

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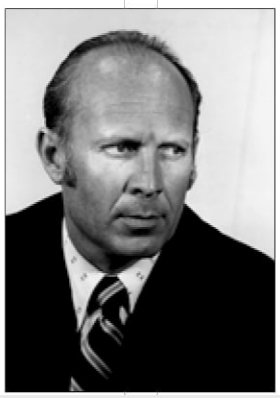
Abstract

The isolated black hole radiation models of Hawking and Zel'dovich are idealized abstractions, because there is always another body to distort the gravitational potential and produce beaming of the radiation. By means of gravitational field emission, it is suggested here that radiation may be emitted from little black holes (LBH) in a process differing from that of Hawking radiation, which itself has proven elusive to detect for over twenty-four years. The effects of a second body are to lower the gravitational barrier of a black hole and to give the barrier a finite rather than infinite width, so that a particle can escape by tunneling or going over the top of the lowered barrier. Gravitational field emission is similar to electric field emission of electrons from a metal in that the emission may be controlled, *i.e.* modulated and beamed. Since 100% of the mass of LBH can be converted to energy and they may be up to 95% of the mass of the universe, they could in principle be an ultimate energy source. These miniscule black holes are excellent candidates for both the missing mass of the universe and ball lightning on Earth. Their radially directed radiation may be the driving mechanism for one of the most remarkable and exciting discoveries of 1998: the accelerated expansion of the universe, with the implication that the universe is older, bigger, and less dense than previously thought. My odyssey with little black holes is presented to illuminate my personal experiences, and to relate my discoveries in a transparent way.



These miniscule black holes are excellent candidates for both the missing mass of the universe and ball lightning on Earth.

1. PERSONAL BACKGROUND

My fascination with black holes goes back to when I first heard of them in my youth. At that time they were not altogether accepted by the scientific community and were in the category of theoretical speculation, as they had not yet been established by empirical observation. They were the stuff of serious musing as well as science fiction flights of imagination. But so were Flash Gordon laser beams, which achieved scientific acceptance well before black holes. It could just as well have gone the other way, since historically black holes had a big head start on lasers.

Black holes were strange objects into which everything fell, and out of which nothing could come out—not even light. Without even knowing that black holes greatly troubled Einstein, I remember pondering if there might not be something overlooked which would prevent such bizarre objects from forming: Could there be an analogous effect to the shielding or attenuation of electromagnetic fields from a conductor? Perhaps at very high densities matter might shield or at least attenuate the gravitational field so that a black hole couldn't quite form. Could there be a polarization counter-effect? But this seemed to require negative mass, an equally dubious entity.

These were fun exercises that I continued for a long time. I remember reading a paperback book on black holes with my son Dan when he was in high school, and sharing some of these thoughts. As I look back on it, when I was still a young physicist and had reached a certain level of sophistication in physics, even I could have constructed a model of how radiation could tunnel out of a black hole, but the thought never entered my mind. I guess the indoctrination that nothing can get out of a black hole was so strong, that even though I entertained the thought of black holes not being able to be created, it didn't occur to me to challenge the core doctrine that was part of the belief in black holes. Sometimes one is inculcated with dogma at such an early stage that one is not even aware that it ever happened. Well, hindsight is generally more accurate than foresight. Though it should be, somehow it wasn't comforting that even Stephen Hawking had difficulty in overcoming the established lore regarding black holes.

I had been happily doing physics at the Stanford Linear Accelerator Center (SLAC) for seven years when the news broke in 1974 that Hawking had shown that black holes can radiate. There was excitement in the air that Hawking radiation could escape black holes quantum mechanically. I had been doing a lot of theoretical and experimental work on field emission, which is the quantum mechanical tunneling of electrons out of a conductor.[1] So I thought to myself that it would be fun to do what I thought was Hawking's calculation, though I hadn't seen it and didn't really know much about it.

But alas, as Robert Burns said, the best laid plans of mice and men often times go awry. While working at SLAC, I was doing consulting for the Electric Power Research Institute (EPRI) on superconductivity and cryogenics when Hawking first published his epoch-making paper. Soon after, I accepted a position to manage superconductivity and cryogenics projects, and act as a resident general scientist at EPRI. (It was in this latter capacity that I later got involved in evaluating things like Nuclear Electromagnetic Pulses, Advanced Electric Power Transmission, Cold Fusion, etc.) As with most moves to a new and challenging job, much gets put off indefinitely, including tasks much more pressing than examining how radiation can escape black holes.

"Roundtuits" are a part of every life. I may never have gotten around to it, if it hadn't been for a chance occurrence. I greatly enjoy reading and discussing books, etc. with family members and friends, and have kept this up over the years. Now that my children are grown, it has to be done with them by long distance telephone—and you can imagine the phone

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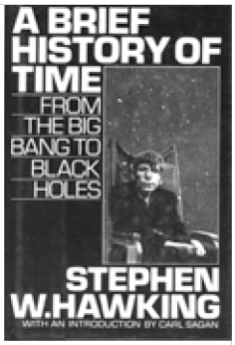
bills. In early 1998, my son Dan and I had just finished reading and deliberating over a philosophical book, when the question came up of which book to read next. Dan said he wanted us to read Hawking's, "A Brief History of Time." Dan majored in philosophy and is an attorney, but he does not have a strong background in physics, so I told him he wasn't ready to go into Hawking's book. It is deceptively simple looking, but is really very deep. I suggested that we read some other easier books first as background.



But Dan was not to be deterred. When we finished the chapter, "Black Holes Ain't So Black," in which Hawking radiation from a black hole is first introduced, I wistfully told Dan that I wish I had done my own calculation, but hadn't gotten around to it in twenty-four years. He urged me to do it now, since if I didn't do it now, I probably never would. I checked to see how my wife Laverne would feel about it. Since I had not been working intently on physics problems, it would mean sacrifices in time spent doing things together. Laverne was very supportive, and unhesitatingly said, "Go for it!"

At the beginning of this quest or odyssey, I had no idea of where it would lead. It could have led to a blind alley with nothing to show for a lot of expended time and effort. Or I might simply have gotten just Stephen Hawking's result, and have been just another me-tooer. Actually, my work went surprisingly well and fast with very few stumbling blocks. I would like to share my journey and results with you. I will try to make it understandable and meaningful. This is not an easy task. As others have also observed, there is probably an uncertainty principle at work in communication just as there is in physics. The product of clarity and precision is likely limited. Equations are presented both to be precise and concise. The narrative will attempt to give life and relevance to the equations, as well as pointing out the surprises and insights that the equations gave me. For those of you who either are not familiar with black holes, or who don't think they exist, I will begin with a short background on black holes.

2. BLACK HOLE BACKGROUND

Everything is connected in some way with everything else. I have yet to find a scientific concept that came into being in isolation, independent of its predecessors. The first concept of a body whose gravitational field is so strong that not even light can leave it, can be traced to John Michell in 1783. Michell found the conditions for a body to have an escape velocity equal to the velocity of light, $c = 3 \times 10^{10}$ cm/sec $\approx$ 186,000 mi/sec = 1 ft/nanosec. The velocity of light was first determined by the astronomer Roemer in 1675 from observations on the moons of Jupiter, and an application of Kepler's laws. That the velocity of light is finite was considered by Galileo in 1638. He and his assistant attempted to measure the speed of light by signaling with shuttered lanterns one mile apart. When the assistant saw light from Galileo's lantern, he unveiled his lantern, and Galileo tried to measure the time interval. He correctly concluded that the velocity was faster than they could measure. In hindsight, we know that a two-mile round trip for light would take only about 10 microseconds.

In 1795, Pierre Simon Laplace rediscovered black holes. However, he retracted his work in light of Young's two-slit interference experiment and Huygens' wave theory of light since he had used a Newtonian particle (photon) approach in his derivation.

The early emphasis on large black holes is historical. The first mechanism for the creation of black holes from stellar evolution was by S. Chandrasekar in 1931 (causing a rift between him and his mentor Arthur Eddington, who didn't believe in black holes). Chandrasekar showed that black holes were the final destiny of all stars with mass $\geq 1.4\ M_{sun}$. That is why all white dwarf stars have mass $< 1.4\ M_{sun}$. Hawking in 1971 was the first to propose that the high energies of the Big Bang created LBH (little black holes) in the primordial universe.[2] (Box 1 indicates the almost unbelievably small size and fantastically high density of LBH. LBH are much smaller, much more dense, and much heavier than elementary particles, and behave in some ways like elementary particles.)

On November 25, 1915 Albert Einstein published a short communication version of his Theory of General Relativity, one of the most profound theories conceived by the human mind. Less than two months later, in 1916, Karl Schwarzchild derived a spherically symmetric solution of Einstein's General Relativity for an uncharged black hole of mass M with no angular momentum, which he sent to Einstein for submission to a journal or academy.[3] It is remarkable that not only did Schwarzchild do this so quickly, but that he did it while fatally ill with pemphigus (a debilitating disease with burning blisters on the skin and mucous membranes), while in active combat in World War I for the German Army on the Russian Front. Einstein presented Schwarzchild's solution on his behalf on January 13, 1916 to the Prussian Academy.

Box 1. Black Hole Sizes and Densities

To create a black hole, an object of mass M must be crushed to a density

$$\rho = \frac{M}{\frac{4\pi}{3} R_H^3} = 7.3\times10^{82} M_{gm}^{-2}\ \text{gm/cm}^3 \quad \text{, where} \qquad (1.1)$$

$$R_H = 2GM/c^2 = 1.48\times10^{-28} M_{gm}\ \text{cm} \qquad (1.2)$$

is the Schwarzchild radius, also often called the horizon of the black hole.

Here are some masses and corresponding densities of various black holes.

$$M_{penny} \sim 1\text{gm},\ r \sim 10^{-28}\ \text{cm} \quad ,\ \rho \sim 10^{83}\ \text{gm/cm}^3 \qquad (1.3)$$

$$M_{mountain} \sim 10^9\ \text{ton} = 10^{15}\text{gm},\ r \sim 10^{-13}\ \text{cm},\ \rho \sim 10^{53}\ \text{gm/cm}^3 \qquad (1.4)$$

10^{-13} cm is the size of nucleons like protons and neutrons.

$$M_{earth} \approx 6\times10^{27}\text{gm},\ r \sim 1\ \text{cm},\ \rho \sim 10^{27}\ \text{gm/cm}^3 \qquad (1.5)$$

$$M_{sun} \approx 2\times10^{33}\text{gm},\ r \sim 1\text{mi} \sim 10^5\ \text{cm},\ \rho \sim 10^{16}\ \text{gm/cm}^3 \qquad (1.6)$$

$$M_{sun} \approx \frac{1}{3}\text{million}\ M_{earth}$$

It is interesting to note that when an object about the mass of the sun becomes a black hole it is gravitationally crushed to > ~ nuclear density:

$\rho \sim 10^{15}\text{gm/cm}^3$. $\rho \sim 10^{16}\ \text{gm/cm}^3$.

By way of comparison, ordinary heavy elements have

$$\rho_{Pb} = 11.3\ \text{gm/cm}^3,\ \rho_{Au,Pt,Os,Ir} \approx 20\ \text{gm/cm}^3 \ .$$

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Box 2. Summary of Tunneling Radiation Analysis (See Section 4 and Figure 1)

Outside the LBH, we need to solve the Schrödinger equation

$$\frac{-\hbar^2}{2m}\frac{d^2\Psi}{dr^2}+\left[\frac{-GmM}{r}+\frac{-GmM_2}{R-r}-E\right]\Psi=0 \qquad (2.1)$$

for $b_1 \le r \le b_2$, where b_1 and b_2 are the classical turning points, and the total energy

$$E = -GmM/b_1 + -GmM_2/(R - b_1) = -GmM/b_2 + -GmM_2/(R - b_2). \qquad (2.2)$$

Transmission probability,

$$\Gamma = \Pi\left[\frac{v_2}{v_1}\right] = \Psi(b_2)\Psi^*(b_2)\left[\frac{v_2}{v_1}\right] \approx e^{-2\Delta\gamma} \quad \text{where} \qquad (2.3)$$

$$\Delta\gamma \approx \frac{m}{\hbar}\sqrt{\frac{2GM}{d}}\left\{\sqrt{b_2(b_2-d)}-\sqrt{b_1(b_1-d)}-d\,\ell n\left[\frac{\sqrt{b_2}+\sqrt{b_2-d}}{\sqrt{b_1}+\sqrt{b_1-d}}\right]\right\} \qquad (2.4)$$

with $d = Mb_1(R-b_1)R/[M(R-b_1)R+M_2(b_1)^2]$, and the solution applies for $R >> b_2$, when $M_2 >> M$. As $R \to \propto$, the tunneling probability$\to 0$.

The time between successive impacts on the black hole barrier is

$$\tau = \frac{2(2GM/c^2)}{c}, \qquad (2.5)$$

where the LBH radius $R_H = 2GM/c^2$. Thus the emission rate from the black hole is

$$\frac{\Gamma}{\tau} = \frac{c^3 e^{-2\Delta\gamma}}{4GM}, \qquad (2.6)$$

A fractional solid angle, $\Delta\Theta / 4\pi$, correction factor needs to multiply eq. (2.6) when the second body is small. For a large nearby body, the emitted power density is low.

The power radiated from a black hole is

$$P_R \sim \langle E_e\rangle \frac{\langle e^{-2\Delta\gamma}\rangle c^3}{4GM}, \qquad (2.7)$$

where $\langle E_e\rangle \approx kT$ is the average energy of the emitted particle.

The Hawking temperature[10] of a black hole,

$$T = \left[\frac{\hbar c^3}{4\pi kG}\right]\frac{1}{M} = \left[2.46\times10^{23}\right]\left(\frac{1}{M}\right)^{\circ}K \qquad (2.8)$$

with M in kg. Combining eqs. (2.7) and (2.8) for the tunneling radiation power:

$$P_R = \left[\frac{\hbar c^6\langle e^{-2\Delta\gamma}\rangle}{16\pi G^2}\right]\frac{1}{M^2} \sim \frac{\langle e^{-2\Delta\gamma}\rangle}{M^2}\left[3.42\times10^{35}W\right] = 60e^{-2\Delta\gamma}P_{SH}. \qquad (2.9)$$

Since $P_R \propto T$ and $P_{SH} \propto T^4$, it is notable that they can be put into an equivalent form.

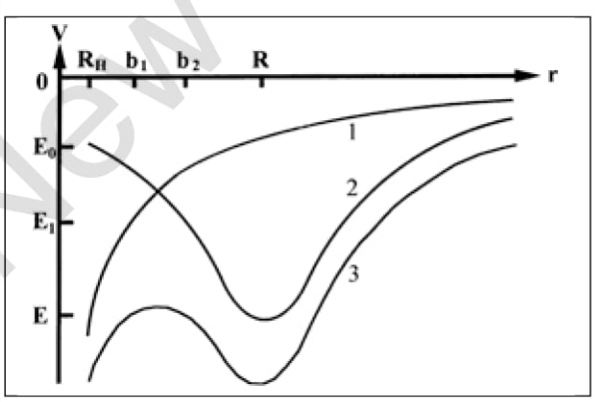

Figure 1. Gravitational Potential Energy Barriers: Curve 1 is the potential of an isolated black hole of Schwarzchild radius RH and mass M at the origin. Curve 2 is the potential of an isolated mass M_2 centered at R. Curve 3 is the resulting effective potential produced by the combination of M and M_2.

Unfortunately, Schwarzchild died June 19, 1916 — too soon to be aware of the importance of his work.

On an astronomical scale, black holes are the centers of attraction of galaxies, and generate the vast power emitted by quasars, the most luminous objects known in the universe—or so most astronomers and astrophysicists believe. Quasars (quasi-stellar objects) were discovered in 1963. These celestial bodies are considered to have been formed fifteen billion years ago at the beginning of the universe. Quasars are an extreme form of active galactic nuclei, powered by supermassive black holes of 10^6 - 10^{10} solar masses, whose luminosity (power output) far exceeds the luminosity of their entire galaxy.[4]

Though black holes were long considered to be a fiction, their existence is now firmly established. In our own galaxy and in the galaxy NGC 4258, the central dark mass is a black hole. In the case of our galaxy, recent measurements of the velocities of stars as close as five light-days from the dynamical center imply a black hole of 2.6 x 10^6 solar masses, as reported in 1998.[5]

3. QUANTUM MECHANICS + GENERAL RELATIVITY = BLACK HOLE RADIATION

Serious problems arise in developing a quantum theory of gravity which have not yet been solved. There may be an intrinsic incompatibility, because quantum mechanics appears to be antithetical to the equivalence principle.[6,7] Zel'dovich[8] and later Hawking[9,10] boldly circumvented these problems in deriving black hole radiation facilitated by quantum fluctuation virtual particle pair production outside a black hole as the ultimate source of the radiation.

The history of black hole radiation is not unlike the history of many other important developments in science. Though Hawking is generally credited with the monumental conception that black holes can radiate, the credit should really go to Yakov Zel'dovich. In 1971 Zel'dovich[8] proposed the first model of radiation from a black hole, "The rotating body [black hole] produces spontaneous pair production [and] in the case when the body can absorb one of the particles, . . . the other (anti)particle goes off to infinity and carries away energy and angular momentum." This is quite similar to the model proposed by Hawking[9] in 1974 for radiation from non-rotating black holes. This relevant prior work by Zel'dovich was not referenced by Hawking in his original papers,[9,10] though he did reference some other work by Zel'dovich, and briefly mentioned Zel'dovich in his 1988 popular book.[11]

4. TUNNELING RADIATION ANALYSIS

4.1 Black Hole Radiated Power

Box 2 shows the analysis for a body of mass M_2 centered at R opposite a black hole of mass M centered at the origin as shown in the potential energy diagram of Figure 1. It is remarkable that a black hole of infinite mass in the presence of another body becomes completely transparent quantum mechanically (tunneling probability, $\Pi = 1$). As an isolated body, a black hole would be completely opaque ($\Pi = 0$). Neverthe-

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ly opaque ($\Pi = 0$). Nevertheless as we shall see, it cannot radiate even when it is completely transparent, since the radiated power $\propto [1/M]^2 \rightarrow 0$.

4.2 Distinction Between Tunneling and Transmission

A distinction must be made between the concepts of "transmission probability or transmission coefficient, Γ" and "tunneling probability or penetration coefficient, Π." Π is a ratio of probability densities and Γ is a ratio of probability current densities. For an Einsteinian black hole there is a relatively small barrier at 1.5 R_H that even virtual particles have to tunnel through to get out. Hawking[9,10] uses the terms "tunnel" or "penetrate" through this potential barrier interchangeably, and does not use the term "transmission." Since his calculations or final results for these quantities are not presented, it appears from context that he is using both these terms for "tunneling probability." The much earlier literature also often did not distinguish between the two concepts. $\Gamma \approx \Pi$ is a valid approximation for a number of cases. However, for non-zero rest mass particles, when their energies are low in a non-symmetrical gravitational barrier, this may not be a valid approximation. This seems to have been overlooked by Hawking and others. It is a good approximation for LBH because low energy particles are a miniscule fraction of the radiation due to extremely high temperatures, but $\Gamma \neq \Pi$ needs to be taken into consideration for intermediate and high mass black holes.

4.3 Black Hole Temperature

The Hawking temperature for a black hole appears to have an inconsistency. Although originally proposed as not being real,[12] this temperature is now asserted and generally accepted as being the gravitationally red shifted temperature. The new view implies an infinite temperature at the horizon of all black holes, since the red shift goes to zero as measured at large distances from any hole if the surface temperature were finite, as shown by eq. (1). For the real temperature, they averred "the effective temperature of a black hole is zero . . . because the time dilation factor [red shift] tends to zero on the horizon." This question deserves further consideration.

Particles that originate at or outside the horizon of an isolated black hole must lose energy in escaping the gravitational

$$\nu_{observer} = \nu(r_{emission\ site})\left[1 - \frac{2GM/c^2}{r}\right]^{1/2} = \nu(r_{emin\ site})\left[1 - \frac{R_H}{r}\right]^{1/2} \quad (1)$$

where $\nu_{observer}$ is the frequency detected by the observer at a very large distance from the black hole, and $\nu(r_{emission\ site})$ is the frequency at the radial distance r from the center of the black hole where the particle pair was created outside the black hole. Eq. (1) does not depend on the gravitational potential between the emission site and observer, but only on the emission proximity to R_H. We see from eq. (1) that for $r = R_H$ and any finite $\nu(r_{emission\ site})$, $\nu_{observer} = 0$ implying that any finite temperature at R_H must red shift to 0 as measured at large distances from a black hole.

potential of the black hole. For example, in the case of photons

Nevertheless, the 1975 Hawking temperature[10] is used here, because it is widely accepted; because my derivation of the temperature inside a black hole is close to the Hawking temperature; and because by having the same temperature as a starting point we can clearly see how our other results differ. (Hawking's 1975 temperature is a factor of 2 higher than his 1974 temperature without explanation.[9,10] The 1974 temperature is prevalently used.)

4.4 Comparison of Hawking Power & Tunneling Power

Note that eq. (2.9) for P_R was obtained without invoking field fluctuations, pair creation, quantum fluctuations of the metric, etc. The Hawking radiation power, P_{SH}, follows the Stefan-Boltzmann radiation power density law σT^4, when

$$P_{SH} = 4\pi R_H^2\left[\sigma T^4\right] = 4\pi\left(\frac{2GM}{c^2}\right)^2 \sigma\left[\frac{\hbar c^3}{4\pi kGM}\right]^4 = \frac{\hbar^4 c^8}{16\pi^3 k^4 G^2}\{\sigma\}\left[\frac{1}{M^2}\right] \quad (2)$$

$\frac{8\pi GME}{\hbar c^3} >> 1.$ For Hawking :

where σ is the Stefan-Boltzmann constant. Although P_R [eq. (2.9)] and P_{SH} appear quite disparate, the differences almost disappear if we substitute into eq. (2) the value obtained for σ by integrating the Planck distribu-, tion over all frequencies: (3)

$$P_{SH} = \frac{\hbar^4 c^8}{16\pi^3 k^4 G^2}\left\{\frac{\pi^2 k^4}{60\hbar^3 c^2}\right\}\left[\frac{1}{M^2}\right] = \frac{\hbar c^6}{16\pi^{-} G^2}\left\{\frac{1}{60}\right\}\left[\frac{1}{M^2}\right] \quad . \quad (4)$$

Thus . (5)

$$\sigma = \left\{\frac{\pi^2 k^4}{60\hbar^3 c^2}\right\}$$

$$P_R = 60\left\langle e^{-2\Delta\tau}\right\rangle P_{SH}$$

It is remarkable that even though $P_R \propto T$ and $P_{SH} \propto T^4$, they can be put into an equivalent form, aside from the numerical factor $60\langle e^{-2\Delta\tau}\rangle$. This was unexpected and I was elated to get this result. The form of eq. (5) suggests that P_{SH} may be interpreted as the radiation inside the black hole, and P_R is the part that tunnels out.

5. DARK MATTER

We only know what 5 % of the accessible universe is made of. One piece of evidence that there must be 95% dark matter or missing mass comes from spiral galaxies. There must be some unseen form of matter whose gravitational attraction is great enough to hold the galaxies together as they rotate, as discovered by the unheralded astronomer Vera Rubin in 1983.[13] The missing mass gives the stars ~ constant linear velocities independent of radial distance r, rather than the expected Keplerian velocities $\propto 1/\sqrt{r}$. Their rate of rotation is so great that they would fly apart if they contained only the stars and gas we can directly perceive. Other pieces of evidence for dark matter come from clusters of galaxies, and the geometry of the universe.

Hawking's black holes could not be the dark matter, because if they were present in the early universe in high numbers at the time of nucleosynthesis, they would have affected its results if the radiation emitted by them either interfered with the nucleosynthesis itself or broke up products of nucleosynthesis after the nuclear reactions were over. The quiescent LBH derived herein[14] are excellent candidates for the missing mass, which is up to 95% of the mass of the universe, as they are much less likely to interfere with nucleosynthesis than Hawking's. Thus my LBH would not be subject to the limits imposed by nucleosynthesis arguments. The baryonic matter (heavy subatomic

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particles like protons and neutrons) trapped in them would have bypassed the deuterium and helium formation that occurred during the era of nucleosynthesis. These quiescent black holes would be present throughout the universe, but would be expected to have a higher number density in galaxies due to gravitational field attraction.

Based on radiation beaming from LBH, one can make provisional predictions regarding galaxy rotation. If the LBH mass distribution is initially uniform, stars in young galaxies will orbit with ~ constant angular velocity, *i.e.* ~ constant period. As the age of the universe gets extremely long with respect to the present age of ~ 10^{17} sec., the stars will orbit with ~ Keplerian periods $\propto r^{3/2}$ as the LBH evaporate away. In the present epoch, stars orbit with ~ constant linear velocity because the total mass of the LBH increases with radial distance from a galactic center due to radiation reaction force driving them outward, as well as a lower evaporation rate at larger radial distances.

LBH as envisaged here are quiescent and can be small compared with the wavelength of visible light, so they will not scatter or occlude light from the distant stars. For example, black holes of between 10^{-7} kg and 10^{19} kg have radii between 10^{-34} m and 10^{-8} m (100Å), well below visible wavelengths of 4×10^{-7} m (4000Å) to 8×10^{-7} m (8000Å). To account for the missing dark matter there would need to be between 10^{61} and 10^{35} such black holes for a universe mass of ~ 10^{53} kg. For our universe of radius 15×10^9 light-year = 1.4×10^{26} m, this would require an average density of between 10^{30} and 10^4 black holes per cubic light-year (10^{48} m^3) and more than this near galaxies. This is orders of magnitude larger than permitted for Hawking's extremely radiative black holes. That many of his LBH would fry the universe! Hawking[11] concludes that for his model, LBH can at most make up one millionth of the matter in the universe, *i.e.* ~300 of his LBH per cubic light-year.

Even with the dark matter being 95% of the mass of the universe, on a solar system size scale the sun's mass dominates over any kind of missing mass, since the volume of the solar system is not large enough to hold enough missing mass based on its average universal density. Thus there is no appreciable deviation from Keplerian motion of the planetary orbits. The distribution of black hole masses in the universe has not been determined experimentally or even estimated theoretically. Gravitational fields of other bodies can both enhance the number density of LBH, and act locally as a filter of LBH masses by radiation reaction force repulsion. There may be sufficient numbers of LBH in the region of the Earth for their presence to be displayed.

6. BALL LIGHTNING

6.1 Little Black Holes as Candidates for Ball Lightning

If greatly decreased radiation permits LBH to be prevalent throughout the universe, then it is reasonable to surmise that they are also present in the region of the Earth. If they are present on Earth, then one may ask how they might manifest themselves. If their presence can help to explain a long-known, well-established phenomenon that has no other explanation, then they are viable candidates for experimental investigations to test the validity of this hypothesis. It appears that ball lightning represents an admirable testing ground.

Ball lightning is one of the few long-known and *widely-accepted* natural phenomena which are still unexplained. It is easy to see why the scientific community has not considered LBH as the core power source of ball lightning, because Hawking's LBH radiate at a devastatingly high rate in all directions[9,10] and that would hardly go unnoticed. Prior to the awareness that black holes can radiate, their presence in the Earth would have been considered highly unlikely, as the Earth would have been devoured after ~ 10^6 years, leaving a black hole of 1 cm radius. But the Earth has existed for over 4×10^9 years. For my model of LBH, the downward directed radiation between the hole and the Earth can provide levitation, with a small horizontal component providing mobility, and the holes radiate considerably less. When they get so small that there would be appreciable radiation, the radially outward radiation reaction force propels them away from the Earth. For these and many other reasons that we shall see, they are excellent candidates to be the source of ball lightning.

The downwardly directed radiation (due to the Earth below) from a LBH will act like a rocket exhaust[15] permitting it to levitate or fall slowly, as governed by eq. (3.6). From eq. (2.8) a < 1 gm little black hole has a temperature T >~ 10^{27} K, so that almost all of its radiation is at extremely high frequencies with energy ~ 10^{23} eV. At a distance of many Earth radii, the radiation is narrowly beamed toward the Earth's center. As the LBH gets close to the Earth, the radiation beam diverges to ~ the Earth's diameter, giving it a low power density as shown in Figure 2. The stopping power for such high energy radiation is not known, but it is likely to dissipate over very long distances. This high energy radiation can itself create particle-antiparticle pairs. All these factors mitigate the local radiation damage near the LBH. Thus a powerfully radiating LBH is not directly visible.

LBH become visible indirectly as ball lightning in the surrounding air by excitation and ionization of the air molecules and atoms in interaction with a charged LBH, and by infalling particle collisions. A LBH at the center of glowing ball lightning has similarities on a relatively miniscule scale to a galactic black hole and accretion disk. The huge disk radiates with enormous protruding jets because of the high speed and high collision rate of molecules falling into the extremely massive but relatively much smaller (in dimension) galactic black hole.

A LBH can trap charge internally and/or externally. An internally charged LBH could easily trap ~ 10 positive or negative charges externally and form a neutral or charged super-heavy ion-like structure. The circulating negative or positive charge that avoids collision with the high energy radiation would tend to move in a plane perpendicular to the emission until precession brings it into a collision with this radiation, eventually contributing to the extinction of the ball lightning. The mass input due to infalling matter is more than countered by a decrease in mass due to the radiation emission. Accumulation of matter into the LBH of ~ 1 gm mass would be somewhat limited to particles with a de Broglie wavelength < the Schwarzchild radius, $R_H \sim 5 \times 10^{-28}$ cm. Thus neutralization

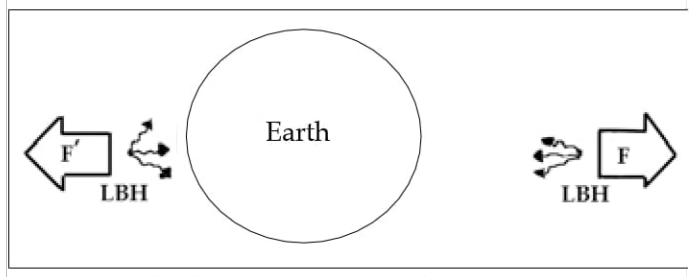

Figure 2. Two Little Black Holes (LBH) Aproaching the Earth: The LBH on the right is further from the Earth, and there is a smaller radiation reaction force F on it directed away from the Earth. The radiation is narrowly beamed. The LBH on the left is closer to the Earth. There is a larger radiation force F' on it, and the radiation is more divergent.

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the Schwarzchild radius, $R_H \sim 5 \times 10^{-28}$ cm. Thus neutralization of the internal charge of a LBH would not occur as rapidly as one might otherwise expect and luminous lifetimes ~10 to 1000 sec may be achievable.

6.2 Little Black Holes Meet Ball Lightning Criteria

The following criteria are presented as a guide for assessing ball lightning models in general, and the LBH model in particular. The criteria are inferred from several sources.[16-19] LBH meet these criteria, whereas generally other models do not.

1) Constant size, brightness, and shape for extended times

The large amount of gravitationally stored energy in LBH and resulting kinetic energy accounts for the somewhat constant size, shape, and brightness of ball lightning; and its particular shape is a function of the motion of the LBH as it drags along ionized air. Ball lightning has stable spherical, pear-shaped, prolate and oblate ellipsoidal, cylindrical, and disk shapes.[16,18]

Models that depend on thermally stored energy do not have stability due to cooling with time. The LBH used for example estimates[15] can have a lifetime ~ 1 year near the Earth. As it evaporates to a much smaller mass, with a concomitant increase in radiation reaction force, it will shoot up into space and thus extend its lifetime. Its luminosity can vanish when its trapped charge becomes neutralized, by going into the ground or other opaque structures, or when the black hole itself becomes disrupted, as possibly when the electrostatic repulsive force of the captured charge ≈ its gravitational force.

There are a number of models that fit this criterion. Finkelstein and Rubinstein[20] proposed that ball lightning is a luminous region of air of nonlinear high electrical conductivity carrying a high current density. They showed that their model can yield ball-like solutions. A similar theory was presented by Uman and Helstrom.[21] Winterberg[22] proposed an electrostatic theory of ball lightning.

2) Untethered high mobility

The lightness of the LBH (~ 1/3 gm in an example calculation[15]) in which the ball lightning mass mainly resides, gives it high-mobility. (Incredibly high-mobility flying saucer sightings may have been ball lightning.) A small horizontal component of the exhaust force accounts for its horizontal mobility. A charged black hole will also experience an attractive force toward its image charge in a conductor, and either a repulsive or attractive force with a charged dielectric, depending on the sign of the charge. Dielectrics tend to accumulate charge in the presence of lightning clouds. Thus, charged LBH can be guided around corners by conductors or dielectrics. Untethered mobility vitiates against electrical discharge models of ball lightning which require attachment to good (*e.g.*, metal) or poor conductors (*e.g.*, earth, wood) such as for St. Elmo's fire.

3) Generally doesn't rise

The ball lightning ionized air is electrostatically bound to the charge trapped in the LBH and so is forced to follow its trajectory rather than simply rise. Since heated air expands and rises, this is another criterion against thermal source ball lightning. Occasionally, ball lightning ascends faster than possible for heated air. Masses << 1/3 gm would rapidly ascend and vanish from the atmosphere. The majority of ball lightning observations are of a slow descent.

4) Can enter open or closed structures

The radius of a 3×10^{-4} kg (~1/3 gm) LBH is $R_H = 2GM/c^2 \sim 5 \times 10^{-31}$ m. Uncharged LBH have mean free paths[23] through matter >> 10^6 km , and the mean free path of charged black holes > > m. LBH thus can easily penetrate through any material. Ohtsuki and Ofuruton[24] have created plasma fireballs formed by microwave interference in air containing ethane and/or methane. These fireballs evidently can penetrate dielectric materials, but not metals. They may have difficulty meeting the requirement of low optical power. Smirnov[25] and others have presented strong arguments that ball lightning cannot be a plasmoid. This criterion militates against most models that require external energy sources.

5) Can exist within closed conducting metal structures

Since LBH have a more than adequate supply of stored energy they can easily exist inside any closed highly conducting structure. However, this criterion dictates against models that depend on electrical currents, microwaves, or other electromagnetic radiation that is shielded out by a conductor. Microwave models such as those of Kapitza,[26] Ohtsuki and Ofuruton,[24] and others would be ruled out in this case.

6) Levitation

The LBH downwardly directed radiation accounts for steady levitation. It is hard for other models to account for steady levitation while moving horizontally for long distances without rising.

7) Low power in the visible spectrum

A LBH produces < 10 W of optical power by ionization of the surrounding air. The bulk of ball lightning observations[16,18] suggest that the observed intensities of light and heat are < ~ 10 W . This criterion rules out all those models for which the total visible radiated power would be far too great for the appropriate color temperature of the ball lightning.

8) Rarity of sightings

Almost everyone has seen lightning, but few people have seen ball lightning. Since LBH are quite rare, this explains the rarity of sightings. Many models are not in accord with this criterion. With galactic concentration of the 95% black hole dark matter, ~ 10^3 LBH may be expected in the region of the Earth of volume 10^{12} km^3 (256 cubic billion miles) with a number density ~ $1/10^9$ km^3 (~1 per cubic billion miles).

9) Relatively larger activity near volcanoes

Bach[16] documents a relatively larger activity of ball lightning near volcanoes. LBH may be involved in volcanic action, making ball lightning more prevalent there. Other models don't explain this.

10) Extinguishes quietly

Ball lightning from LBH extinguishes its luminosity quietly when it enters opaque materials like the ground or structures, slows down considerably, comes to rest, or becomes neutralized.

11) Extinguishes explosively occasionally

Ball lightning sometimes releases energy explosively.[16,18] LBH occasionally extinguish explosively as their mass → 10^{-8} kg, or when otherwise disrupted. In 1846, lightning accompanied by fireballs that "descended and exploded with terrific force" demolished the stone steeple of St. George's church in Leicester.[27] In examining the remains of the steeple apex, Mills[27] detected no radioactivity. He considered that radioactivity may have been undetectable because of the 125-year time lapse, but could be detectable "within days of a ball lightning strike."

12) Related radioactivity

Mills was testing the Altschuler *et al.*[28] model that ball lightning arises from a concentration of short-lived radioisotopes produced by lightning. There can be a low-level of γ-rays, positrons, and other radioactivity associated with ball lightning.[18] Ashby and Whitehead[29] tested the hypothesis that ball lightning is caused by antimatter meteorites. They made radiation measurements over a period of one year near thunderstorms and tornadoes to check whether the annihilation of minute fragments of meteoric antimatter in the upper atmosphere could be the cause of ball lightning. Though radioactiv-

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ity was detected, they seem to have disproved both the Altschuler *et al.* hypothesis[28] and their own model.[29] LBH can account for radioactivity, whereas most other models cannot.

13) Typical absence of associated deleterious effects

Because of the low interaction cross section of the emitted radiation, the great amount of emitted power from LBH has low power density near the Earth and low local power deposition, dissipating over a huge volume.

Since 100 % of the mass of LBH can be converted to energy and they may be up to 95% of the mass of the universe, they could in principle be an ultimate energy source if they can be safely trapped and harnessed.

14) Occasional high localized energy deposition

Some ball lightning incidents require MJ of energy to account for molten materials and boiling away of a bathtub full of water.[16,18] The high energy content of LBH (>> MJ) can account for this when LBH are disrupted by an end of life burst, or move through a much higher density material than air.

15) Larger activity associated with thunderstorms

Thunderstorm activity may be involved in the charging of LBH, and/or the high fields[30] associated with thunder clouds may attract charged LBH. During lightning, runaway high energy charged particles in the high energy tail of the Maxwellian distribution have more of a chance of being captured by the black hole due to their shorter de Broglie wavelengths. The potential of charged clouds may get as high as 10^9 V.[31]

7. THE ENIGMATIC UNIVERSE

7.1 Introduction

In 1691, Newton was probably the first to make a physics argument in favor of an infinite universe that can't collapse. Based upon his theory of gravitational attraction, he reasoned that since stars can only attract each other, they would eventually all collapse to a central point if the universe is finite. However, he argued that for an infinite universe with a roughly uniform distribution of stars, there is no central point since each point would have an infinite number of stars on all sides. This is a very reasonable argument. But like many reasonable assertions, it is possible to make an even stronger argument for the opposite view.

If the universe is uniform and has spherical symmetry, then we can imagine an infinitude of concentric spherical shells filled with stars. For the space surrounding each shell, its mass acts as if it is concentrated at the center of the sphere. Each shell has a uniform gravitational potential for the space which it surrounds and hence exerts no force on the bodies at smaller radii, but attracts all bodies at larger radii toward the spherical center. So from this point of view, whether there are a finite or infinite number of spherical shells, stars would still collapse to a point if they weren't propelled radially outward.

7.2 Big Bang Universe

Whether one takes a single universe or a multiverse point of view, in my opinion there appears to be no reasonable opposition to the Big Bang—although some disagree. Fred Hoyle originally coined the "Big Bang" as a disparaging term, and helped to develop the steady state universe model as an alternative. Now even this warrior, who fiercely opposed the Big Bang, seems to have modified his views to at least allow for some kind of a "bang" or succession of "little bangs." Many astrophysicists and cosmologists consider that the universal microwave background radiation together with the expansion of the universe argues for a Big Bang[32] as surely as that the Earth is round and that it goes around the Sun. Though arguments for the antithesis of all this can be made, in my view they can easily be countered. The Big Bang hypothesis is in excellent agreement with the universal microwave background and with the relative universal abundances of the light elements such as hydrogen, deuterium, and helium.

Although the Big Bang is generally accepted, its initial singularity problem continues to be troubling. General Relativity implies that at time zero, the universe was a point of zero volume with infinite density, temperature, etc. Gabriele Veneziano[33] avoids this singularity using string theory in which conventional point-like particles are replaced by one-dimensional strings having a very short length. Not only are the troublesome infinities disposed of, but string theory endows the universe with a past before the Big Bang. Previously we were told that there was no "before." Now we may view the evolution leading to the Big Bang in much the same way as the collapse and explosion of stars.

7.3 Inflationary Universe

Inflation theory comes into play within a tiny fraction of a second after the beginning of our universe, so that distant outer-boundary regions were able to communicate their light before becoming too distant to do so. Inflation theory views the early universe as expanding outward at an exponential rate (hence the name "inflation") from a central point. With this hypothesis, many long-standing cosmological problems can be laid to rest—such as the homogeneity of the universe. It enables us to comprehend how the diametrically opposite ends of the universe that are some twenty-four to thirty billion light-years apart can be so much alike (implying that they somehow communicated with each other), despite the fact that light exchanged between them can only have traveled some twelve to fifteen billion light-years since the beginning of the universe.[34] However, there is a price to laying these and other problems to rest.

The price to be paid is that the very early universe had to fly apart much faster than the speed of light—in apparent contradiction to relativity theory that no material objects can go faster than the speed of light. Inflation theorists simply shrug their shoulders and say that their theory does not violate relativity, since it is not the proto-stars and proto-galaxies that were moving that fast, but rather the very fabric of space itself moving the material objects apart. It's too bad that Einstein was not alive to comment on it himself when inflation was proclaimed and almost universally accepted. One can only wonder how accepting of it he would have been.

Standard inflation theory is very hard to test experimentally. Although it neatly pushes aside the Creator's hand in setting up initial conditions with extreme precision, it lacks a deep theoretical basis. Despite eighteen years of polishing, it still has rough edges of arbitrariness. Inflation might be put in the category of science fiction, were it not for testable predictions coming out of pre-Big Bang string inflation theory.[33]

7.4 Accelerated Expansion of the Universe

The recent discovery of the accelerated expansion of the universe was totally unanticipated. It calls long-standing cosmological theories into question. It may shed light on the enigma that some stars appear to be older than the previously accepted age of the universe. The implication is that the universe is older, bigger, and less dense than previously thought. One viable explanation that emerges is related to acceleration due to radially inward radiation from LBH. The new discoveries radically change our con-

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cept of what drives the macrocosm, and initiate a fundamentally new quest for the laws that govern the universe on a large scale.

Our universe is so full of surprises that caution should always be the byword. An old saying has it that cosmologists proceed undaunted in being almost always certain but rarely right. This has been the case with regards to the character of the expansion of the universe. It has long been taken for granted that the present expansion of the universe is either at a constant rate, or decelerating due to the gravitational attraction of all the mass in it. So it came as quite a surprise in 1998 when two independent international groups of astrophysicists at Lawrence Berkeley National Lab[35] in the the U.S., and Mount Strombo and Siding Spring Observatories[36] in Australia, using type Ia supernovae to gauge distances, discovered that the universe is accelerating in its expansion.

If LBH represent a substantial fraction (up to 95%) of the missing mass of the universe,[14] then (as we shall see) their radially directed outward radiation is a good candidate model for the accelerated expansion of the universe. It appears that only Einstein's cosmological constant and inflation have been considered as explanations thus far. Directed tunneling radiation from LBH due to interaction with the universe as the second body is another possible explanation.[14] Since there is relatively little antimatter in our universe, it would not be surprising if for similar reasons, antimatter tunnels out of black holes in smaller quantities than matter. One would expect equal amounts of matter and antimatter in Hawking radiation.

According to General Relativity, mass determines the curvature of space, and curved space determines the motion of mass in that space. Overall mass density determines the geometry of the universe. We are accustomed to the notion that it is not meaningful to think of the universe as having a center of mass. If the universe is a three-dimensional surface of a four-dimensional sphere (finite but unbounded), then the center of mass is outside the three-space—just like the center of mass of a balloon is not in the surface of the balloon. Similarly, the center of mass is outside the three-space, if the universe is hyperbolic. But, if the universe is Euclidean (flat space) the answer is not as clear. If the universe is infinite, then one might think that any point could serve as the center, since any point has an infinite number of points on all sides of it. However if the universe has spherical symmetry, then the center of mass has meaning if a succession of homogeneous spherical shells are added around a small sphere. Even with an infinite number of spherical shells, the center of mass still remains at the center of the first sphere.

Based upon the microwave background, the estimated mass density of the universe, and other observations, it is generally thought that our universe is Euclidean, *i.e.* flat rather than closed curvature, or hyperbolic. In this space, let us determine the maximum acceleration observable from the Earth due to the radiation reaction force experienced by a LBH of mass M in a spherical shell at radius R, with velocity v relative to us, surrounding mass m of the universe. The universe as a whole dominates in the creation of the net radiation force on LBH since the effects from nearby matter tend to cancel due to homogeneity. For a first approximation, let us ignore the deceleration term due to gravity. Bodies at the edge of our visible universe are moving out radially near the speed of light, thus a general treatment for all radii needs to be relativistic, as shown in Box 3. A non-relativistic treatment of the effects of the gravitational field is also given; however this is not presented relativistically as it is too complex to be included here.

If the total mass of a spherical shell of the universe is dominated by an ensemble of LBH, then their acceleration will transport the rest of the bodies in the shell with them by gravitational attraction. The acceleration of each shell will not exceed the value given by eq. (3.5) or (3.9). Eq. (3.9) may apply to the more than fifty measurements of the type Ia supernovae made at a distance of only a few to several billion light-years.[35] The most recent and definitive measurement of accelerated expansion is at a distance of about 6 billion light-years.[35,36]

Box 3. Little Black Hole Accelerated Expansion of Universe

(See Section 7)

As seen from the Earth, the acceleration is

$$a = \frac{dv}{dt} = \frac{-c}{M}(1-\beta^2)\frac{dM}{dt} \quad , \qquad (3.1)$$

where $\beta = v/c$, and $\frac{dM}{dt} = \frac{-P_R}{c^2}$.

The power radiated from a black hole due to the presence of a distant body is given by eq. (2.9), largely directed along the line from the center of mass of the black hole to the center of mass of the second body. From eq. (2.4)

$$\Delta\gamma = \frac{m}{\hbar}\sqrt{\frac{2GM}{d}}\{b_2 - b_1\} \qquad (3.2)$$

since b_2 and b_1 are both >> d; and $d = MR/m$ as R >> b_2 and m >> M. Thus eq. (3.1) becomes

$$a = \frac{(1-\beta^2)}{M^3}\left[\frac{\hbar c^5}{16\pi G^2}\right]\left\langle \exp-\left[c\frac{b_2 - b_1}{2\pi M}\sqrt{\frac{2M}{GR}}\right]\right\rangle \quad . \qquad (3.3)$$

From da/dM = 0, in eq. (3.3) we can find the relationship between M and (b_2 - b_1) for maximum acceleration,

$$\frac{(b_2 - b_1)}{M} = \left[\frac{c}{6\pi}\sqrt{\frac{2M}{GR}}\right]^{-1} \quad . \qquad (3.4)$$

Eq. (3.4) into eq. (3.3) greatly simplifies the exponential, giving the maximum possible acceleration:

$$a_{max} \le \frac{(1-\beta^2)}{M^3}\left[\frac{\hbar c^5}{16\pi G^2}\right]e^{-3} \qquad (3.5)$$

Note that even though R was used to derive eq. (3.5), it is independent of R.

For black hole velocities v ≤ 0.7 c the above relativistic correction is less than a factor of 2, so let us look at the non-relativistic case for these lower velocities.

$$a = \frac{dv}{dt} = \frac{-c}{M}\frac{dM}{dt} - \alpha \quad , \qquad (3.6)$$

where -α is the gravitational deceleration term due to gravity. For a Euclidean spherically symmetric universe, and to the extent that Newtonian gravitation applies

$$\alpha = \frac{GM}{R^2} = \frac{GMR}{R^3} = \frac{4\pi}{3}G\rho_u R \quad , \qquad (3.7)$$

where ρ_u is the average mass density of the universe inside the radius R of the spherical shell.

Substituting into eq. (3.7) as in the relativistic case,

$$a = \frac{1}{M^3}\left[\frac{\hbar c^5}{16\pi G^2}\right]\left\langle \exp-\left[c\frac{b_2 - b_1}{2\pi M}\sqrt{\frac{2M}{GR}}\right]\right\rangle - \alpha \quad . \qquad (3.8)$$

Maximizing the acceleration as before,

$$a_{max} \le \frac{1}{M^3}\left[\frac{\hbar c^5}{16\pi G^2}\right]e^{-3} - \alpha \qquad (3.9)$$

8. DISCUSSION

8.1 Unobserved Hawking Radiation

Hawking radiation has not been observed after over two decades of searching.[37] Scientific papers[38-40] have been written

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offering reasons why it may not be observable. For example, De Sabbata and Sivaram suggest that "Thus one may observe the decay [Hawking radiation] only if one makes an infinite succession of measurements. So in a sense one may never be able to observe the Hawking effect."[37] The radiation described in the present paper differs substantially from Hawking's, and a case is made here that it has already been observed indirectly in ball lightning; and possibly also in the detected gamma-ray background.

John March-Russell and his colleagues conclude that the properties of LBH are greatly altered and LBH radiation is considerably attenuated from that of Hawking's prediction. For them, not only is the radiation rate as much as a factor of 10^{38} lower, but it also differs in being almost entirely gravitons.[40] They consider that the observed weakness of gravity at long distances is due to the existence of additional spatial dimensions at sub-millimeter distances, beyond the three that we normally experience. Though this may have been considered radical as recently as a decade ago, it is now mainstream physics with many papers on the effects of extra dimensions being published by many physicists in many orthodox journals.

There is no equation given for the power radiated from a black hole in Hawking's early seminal papers. In 1972, Jacob Bekenstein made the astounding and far-reaching conclusion that a black hole's surface area is its entropy in disguise.[41-43] Originally Hawking argued vigorously against this, but embraced this concept to achieve black hole radiation.

8.3 Tunneling Radiation

The tunneling radiation derived herein originates from within a black hole. The expected profile for Hawking radiation has not been observed.[37] As we shall see, tunneling radiation can be emitted at much higher temperatures in the present epoch than Hawking radiation, and thus may be able to fit the detected gamma-ray background, and possibly serve as a model for gamma-ray pulsars. Since Hawking[9,10] appears not to have included an explicit expression for the tunneling probability or transmission, it is reasonable to assume that the tunneling out of a black hole here is different than that of Hawking.

My tunneling of radiation out of a black hole, assisted by a second body, can be thought of as analogous to electric field emission. Field emission is a well-established phenomena both experimentally and theoretically, and there is no reason that it cannot occur for the gravitational field just as it does for the electric. The second body also lowers the potential energy barrier. This can be thought of as the analogue of Shottky emission at ambient temperature. Given other circumstances, I might have done this analysis twenty-five years ago. This is not to say that I could have anticipated a connection to dark matter, ball lightning, and the accelerated expansion of the universe. These came much later. So there is something to be said for the benefit of a long hiatus in terms of knowing about related developments that have happened since 1974.

Even when I was doing my calculations in 1998, I did not anticipate that this work could relate to these important topics. Sometimes one's work yields deeper insights than one thinks he is putting in. When Art Cohn and I showed that tunneling could also be understood classically[44] (which the lore said couldn't be done), we did not anticipate that our equations would also give reflection even when the tunneling particle has enough energy to go over the potential energy barrier. We would have settled for the particle just getting through the barrier when it does not have enough energy to go over.

8.4 Little Black Holes as an Ultimate Energy Source

Since 100% of the mass of LBH can be converted to energy (only ~14% for fission or fusion) and they may be up to 95% of the mass of the universe, they could in principle be an ultimate energy source if they can be safely trapped and harnessed. From the work herein, it appears that the radiation from black holes can be controlled, *i.e.* turned on and off, modulated, beamed, etc. It may be possible to harness the power radiated from small black holes to be the ultimate power source for advanced civilizations. As a power source, when all the available energy mc^2 is utilized, there are no ashes left, as with chemical and fission and hot fusion nuclear energy sources. A 1 kg (~2 lb) LBH could be opened up to deliver 10^6-10^{29} MW and finally vanish.

9. CONCLUSION

Our world and the universe around us are indeed enigmatic. They often turn out to be more enigmatic than we imagine. And we shouldn't be amazed if they turn out to be more enigmatic than we *can* imagine. Theory and experiment must work together intimately. Experiment rather than theory is the ultimate arbiter of science, though we should bear in mind that theory plays a crucial part in every experiment. The possible connections I have found between LBH and dark matter, ball lightning, accelerated expansion of the universe, etc. will be decided by experimental observation, not by opinions for or against.

Acknowledgment

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References

1. M. Rabinowitz, "Electrical Conductivity in High Vacuum." Stanford Linear Accelerator Center Report, SLAC-TN-68-23; 38 pp. (1968).
2. S.W. Hawking, Mon. Not. R. Astron. Soc. **152,** 75 (1971).
3. S. Chandrasekhar, *The Mathematical Theory of Black Holes*, Oxford Univ. Press, N.Y. (1983).
4. P. Davies, *The New Physics*, Cambridge Univ. Press (Great Britain, 1992).
5. R. Genzel, *Nature* **391**, 17 (1998).
6. A.W. Overhauser, R. Colella, and S.A. Werner, (1975). *Physical Review Letters* **34**,1472.
7. M. Rabinowitz, *IEEE Power Engineering Review* **10**, No. 4**,** 27 (1990).
8. Ya. B. Zel'dovich, *JETP Letters* **14**, 180 (1971).
9. S. W. Hawking, *Nature* **248**, 30 (1974).
10. S.W. Hawking, *Commun. Math. Phys.* **43**, 199 (1975).
11. S.W. Hawking, *A Brief History of Time*, Bantam Books, New York (1988).
12. J. M. Bardeen, B. Carter, and S.H. Hawking, *Commun. Math. Phys.* **31**, 161 (1973).
13. V.C. Rubin, *Science* **220**, 1339, (1983).
14. M. Rabinowitz, IEEE Power Engineering Review, **18** No. 8, 24, (1998); and **10**, No. 11, 8 (1990). RC Tribune, 9a, June (1998). *21st Century Science & Technology* **11**, No. 2, 6 1998.
15. M. Rabinowitz, IEEE Power Engineering Review, **19** No. 3, 65, (1999).
16.E.W. Bach,*"UFOs" from the Volcanoes*, Hermitage Publishers, Tenafly, NJ. (1993)
17. D. Fryberger, *Proc. Unidentified Atmospheric Lightning Phen.*, 1 (1994).
18. S. Singer, *The Nature of Ball Lightning, Plenum Press*, New York, NY (1971).
19. M.A. Uman, *J. Atmos. & Terr. Phys*. **30**, 1245 (1968).
20. D. Finkelstein, and J. Rubinstein, *Physical Review* **A135**, 300 (1964).
21. M.A. Uman, and C.W. Helstrom, *J. Geophys. Research* **71**, 1975 (1966).
22. F. Winterberg, *Zeitschrift fur Meteorologie* **28**, 263 (1978).
23. G. Greenstein, and J.O. Burns, *Am. J. Phys.*. **52**, 531 (1984).
24. Y.K. Ohtsuki, and H. Ofuruton, *Nature* **350** , 139 (1991).
25. B.M. Smirnov, 1990, *Phys. Rep.* **188**, 1.
26. P.L. Kapitza, *Zh. Tek. Fiz.* **38**, 1829 (1968).
27. A. A. Mills, *Nature Physical Science* **233**, 131 (1971).
28. M.D. Altschuler, L.L. House, and E. Hildner, *Nature* **228**, 545 (1970).
29. D.E.T.F. Ashby, and C. Whitehead, 1971, *Nature* **230**, 180.
30. J.D. Cobine, *Gaseous Conductors*, Dover Publications, New York (1958).
31. M. Rabinowitz, *The Nuclear Electromagnetic Pulse and the Electric Power Grid: A Different Perspective*, Electric Power Research Institute, Report EL-4351-SR (1987).
32. E.F. Mallove, *The Quickening Universe*, St. Martin's Press, N.Y. (1987).
33. G. Veneziano, Cern Courier **39**, 38 (1999).
34. E.F. Mallove, *Sky and Telescope*, Sept., 253 (1988).
35. S. Perlmutter *et al.*, *Nature* **391**, 51 (1998).
36. A.G. Riess *et al.*, *Astronomical Journal* **116**, 1009 (1998).
37. F. Halzen, E. Zas, J.H. MacGibbon, and T.C. Weekes, *Nature* **353**, 807 (1991).
38.V. De Sabbata, and C. Sivaram, *Black Hole Physics*, Kluwer Acad. Publ., Boston (1992).
39. R. Balbinot, *Classical & Quantum Gravity* **3**, L107 (1986).
40. P.C. Argyres, S. Dimopoulos, and J. March-Russell, *Phys. Lett.* **B441**, 96 (1998).
41. J.D. Bekenstein, *Nuovo Cimento Letters*, **4**, 737 (1972).
42. J.D. Bekenstein, *Phys. Rev. D*, **7,** 2333 (1973).
43. J.D. Bekenstein, *Phys. Rev. D*, **9,** 3292 (1974).
44. A. Cohn, and M. Rabinowitz, *International Journal of Theoretical Physics*, **29**, 215(1990).

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Press Responses to the Tenth Anniversary of Cold Fusion

by Eugene Mallove

NPR Science Friday with Ira Flatow (April 9, 1999)

We can only say *Bravo!* for Ira Flatow's NPR program on cold fusion that aired on Talk of the Nation "Science Friday," April 9. In a fifteen-minute segment that followed another subject (internet security and censorship), Russ George of Saturna Technologies, Inc. was interviewed about his successful replication and augmentation of the Les Case experiment, catalytic fusion in heated heavy hydrogen gas. He described the work of detecting helium growth in a cell based on Case's process. He pointed out that no helium growth was present in the ordinary hydrogen control cell. Russ George is to be congratulated for describing a world-class cold fusion experiment clearly, and concisely for a national audience.

Michael Schaffer, an *IE* subscriber, appeared on the program to comment on the Russ George experiment. He is to be congratulated for his world-class open mindedness in considering Russ's data. It was clearly stated that he works at General Atomics on hot fusion. This made his presence on the program all the more significant.

We were pleased with Ira Flatow's statement that *no critic* was willing to come on the program to comment. Good! At long last a standard has been set whereby discussions of cold fusion do not require comment from people such as Douglas Morrison or John Huizenga, who have not given a minute's worth of consideration to the latest experiments in cold fusion.

"Power to the People: The Return of Cold Fusion"
by Hal Plotkin, Special to *SF Gate*

This was an absolutely *marvelous* internet website article by a print and broadcast journalist, whose acquaintance I had never met, San Francisco-based Hal Plotkin of "SF Gate." The piece was *right on target*. It told of the forthcoming presentation by Dr. Michael McKubre at the APS meeting in Atlanta on March 26.

At every turn, Plotkin got the story right on. Witness: "Nonetheless, then—as now—almost everyone working in fusion research gets paid to explore one part or another of the dominant theory about how fusion works; which is that nuclear fusion is possible only at very high temperatures. Funding work on this one theory, and this one theory alone, is a classic recipe for the creation of scientific group-think. When everyone 'knows' the world is flat, no one risks sailing toward the horizon."

Mr. Plotkin noted the viciousness of the anti-cold fusion assaults: "The attacks on Pons and Fleischmann were incredibly vicious, perhaps because they were seen as heretics operating outside their field of expertise. I remember, for example, covering one scientific gathering in Los Angeles as an editor for the public radio program, 'Marketplace.' It was shortly after Pons and Fleischmann had made their initial announcement...One prominent physicist at Caltech derided Pons and Fleischmann with invectives I had never before witnessed at a scientific gathering. I later likened it, in my nationally broadcast report, to the kind of trash talk one hears in the build up to a heavyweight title fight...One by one, influential scientists, most of them physicists on the federal dole, denounced cold fusion as being either scientific idiocy or outright fraud."

Plotkin reports how difficult it was for him to get air time on radio due to the growing bigotry against cold fusion: "Despite the onslaught of negative reports, I wanted to do more stories about cold fusion. It struck me even then that many of the researchers I had interviewed seemed quite credible. Within one year of the first announcement, there were already at least a dozen well-respected scientists at major academic institutions who said they too were observing what has since come to be called 'anomalous heat' in Pons-Fleischmann cells. These scientists wanted to know where that heat was coming from. So did I."

"Unfortunately, my colleagues on our public-radio program's editorial staff had other ideas. By then, a consensus had already emerged: cold fusion was junk science. I was too close to the story, I was told. Find something else to report on. Don't make a damn fool of yourself."

Thus did public radio stifle a reporter, Plotkin, who was in the right, while the ruling majority was dead wrong.

The experience went beyond Public Radio. It affected, for example, the extent of Jerry Bishop's reporting in the *Wall Street Journal* on cold fusion, severely curtailed, he told me, by higher-ups who were afraid the *WSJ* might look silly. (*The Wall Street Journal* produced no cold fusion story around March 23, 1999, even though I had provided copious reference material to two of their top staff writers—one of whom told me he *agreed* with the now retired Bishop!)

Writes Plotkin, "My experience wasn't unique. The big chill set in at most major media outlets, and stories about cold fusion were frozen out. Within a few short months, the very words 'cold fusion' would come to be synonymous with hoax. I kept my cold-fusion file tucked away all these years, but never reported on the subject again. As a result of the personal attacks on Pons, Fleischmann, Bockris, and others, the atmosphere of free and open inquiry that science requires was almost completely destroyed. Fearing similar assaults, many scientists were afraid to study the phenomena or discuss it publicly."

We look forward to more fine stories by Mr. Plotkin.

"A Tempest in a Test Tube, 10 Years Later," *New York Times*,
by William J. Broad, "Science Times," March 23, 1999

Wonder of wonders! Bill Broad of the *New York Times* called *me*, I did not call him, about a week before March 23, 1999. Bill hadn't written anything on cold fusion since 1991, though his *NYT* colleague, Andrew Pollack, then based in Japan, had written a very good piece November 17, 1992, in which he compared the Japanese and U.S. attitudes about cold fusion.

Bill told me straight off that he was going to do a Tenth Anniversary piece, so I delivered massive information overload to the esteemed *NYT* headquarters—pronto. Bill must have called me back a dozen times through the week to check facts and nuances.

His piece made quite clear that cold fusion research continues worldwide, but that it is not accepted in mainstream circles. He wrote, "Surprisingly, despite a decade-long cold bath of criticism, cold fusion is alive today and is apparently doing well in the scientific underground." There could have been much more focus on how the science actually had progressed, but the article came out far better than one could have expected weeks before. There could have been *no* story—which was was the case with the *Wall Street Journal* this time.

Broad quoted the unrepentant John Huizenga, the DOE hatchet man of 1989, "It's as dead as ever. . . It's quite unbelievable that the thing has gone on for 10 years. But it's the same group of people and they don't want to take no for an answer." What a pompous fellow that Huizenga! He presumes that cold fusion scientists should "take no" from an "authority" such as himself.

Bill Broad was very kind in quoting this editor, and naming *Infinite Energy* in a section that ran five paragraphs long. We hope that he will call again as the science and technology develops.

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Time Magazine's "Time-100" Special Issue of March 29th, "Cranks, Villains, and Unsung Heroes" (pg. 196)

On the other extreme, this article just about hit the bottom of the barrel in insulting, ignorant reporting on cold fusion. Its four authors received the following letter from this editor:

To: Frederic Golden, Leon Jaroff,
Jeffrey Kluger, Michael D. Lemonick

March 31, 1999

Dear Sirs:

I do not know which of you were primarily responsible for the vile outrage of designating Drs. Fleischmann and Pons as "Cranks" in your March 29, 1999 "Time-100." To witness them portrayed in infamy on the same page (albeit in a different category) as the Nazi villain Josef Mengele, stretches my tolerance for your so-called science reporting to the limit.

Since all of you are signed as authors of this most reckless assertion about Fleischmann and Pons, I am sending to each of you a possible corrective for your intellectual confusion: Issue No. 24 of *Infinite Energy*, which celebrates the Tenth Anniversary of the cold fusion announcement. In particular, I draw your attention to our selection of the top thirty-four referenced technical papers in peer-reviewed and non-peer reviewed literature that show clear evidence for the cold fusion class of phenomena. You should also examine the historical facts presented in this issue, which are at variance with the cartoon history that intellectually challenged "science journalists" such as yourself routinely parrot.

I have scant hope that scientific papers and correct historical facts can influence people who were so thoughtless in this nearly libelous disparagement of these two discoverers. Still, I would welcome a sincere effort on your part to give *Time* readers the correct story. Had you placed Fleischmann and Pons in the category of "unsung heroes" on the next page—along with Alfred Wegener—you would have been correct. You chose instead to present a highly misleading cartoon of what really happened to these pioneers and what is going on in the cold fusion field today. This attack on two outstanding scientists and those many hundreds of scientists who continue their work constitutes journalistic sloppiness at its worst.

Sincerely,
Dr. Eugene F. Mallove
Editor-in-Chief, *Infinite Energy*

Physics World, "Whatever Happened to Cold Fusion?"
by David Voss, March 1999 (pp.19-20)

Author David Voss received extensive material and briefing from this editor. Disappointed, but not surprised by his article, I wrote to him afterward: "Your article was not very flattering to cold fusion researchers, but we have learned to deal with 'less than optimal' publicity. Some news—even if unflattering—is better than no news, as far as we are concerned."

The title of the article was entirely appropriate. It was subtitled accurately: ". . .cold fusion has been largely dismissed by the scientific community. But, as David Voss discovers, some researchers remain adamant that this supposed new energy source is real, and are pressing ahead with their own experiments." Unfortunately, the article went largely downhill from there.

• Voss did not provide a *single* reference to any of the many peer reviewed technical papers that have appeared in the literature. Quite a feat! Is this a fair standard of reporting for a scientific journal that wishes to let its readers judge on the basis of peer-reviewed (or non-peer-reviewed) literature?

• Voss wrote, "However, it is clear that world energy production has not been affected in any way by cold fusion." This is non-sequitur with a negative connotation. So what! The same can be said for thermonuclear fusion research too—a not so subtle put-down.

• He wrote, "Most of the big funding sources, which threw money at quick experiments in the early days of cold fusion, have pulled out." Of course they have! That was their objective and transparently so. Do a quick experiment, "disprove" the effect, and get on with their traditional funded projects. If Voss was including NCFI and EPRI/SRI among the people who "pulled out"—it is unfair not to have reported through references to the technical literature that EPRI and NCFI *both* concluded affirmatively on the P&F effect. (Voss had a selection of at least what most of us deem to be among the best experiments.)

• Fair enough to have quoted Douglas Morrison of CERN, but Voss should have known by what I sent him that Morrison has no basis for saying there is "less science and fewer scientists. . ."

• When Voss referred to cold fusion researchers as a "circle of enthusiasts" and "believers," he demeaned many good scientists. This kind of language has become acceptable journalistic practice against cold fusion. The effect of this kind of language: it is to plant in the reader's mind a negative view of these scientists. Suppose we were to say a "circle of enthusiasts for the elusive top quark" and "believers in the top quark"—how would that go down?

• Voss made an obvious technical error, when he wrote, "a couple of palladium electrodes." *No!* The P&F cell uses a Pt anode and a Pd cathode.

• The University of Utah did not "fail to reproduce the earlier results." Fritz Will *et al.* of NCFI produced an excellent peer-reviewed paper on reproducible tritium production. There emerged several excellent papers—*Physics Letters A* and *J. Elec. Anal. Chem.*—from P&F themselves on the excess heat, the direct output of this NCFI work.

• "As time went on, all but the diehards gave up, and the major reputable labs lost interest and dropped out of the experimental game." Wow! Voss has "diehards" now—just for literary variation from "enthusiasts" and "believers"? "The major reputable labs lost interest"—is SRI International not a reputable lab? Is Tom Claytor at Los Alamos not at a "reputable" lab? Is hot fusion scientist Arata in Japan not at a "reputable lab"? If Voss is talking about Caltech, MIT, and Harwell, I think he has to begin to ask himself just how "reputable" these labs were since there are papers out now calling into question all of their rush to judgement work.

• I am at a total loss to understand Voss's line, "Yet the defenders of cold fusion have soldiered on, a number of them merging with a network of conspiracy theorists, psychic spoon benders, UFO enthusiasts, and believers in other exotic phenomena outside the ken of science."

On and on the flaws went. I'll truncate this list with that last comment. Check them for yourself. So much for a former physicist's attempt to write an even partially balanced piece on cold fusion.

10 years after announcement, cold fusion has adherents, but for most, it's . . . A Cold Fiction

by Lee Siegel, *Salt Lake Tribune*, Sunday, March 21, 1999, (pp. A1-A.7).

Whenever Lee Siegel calls me for one of his perennial sloppy pieces on cold fusion, I cooperate. He wants sound bites, so I give them, knowing full well that he is absolutely *hopeless* as a science reporter on the cold fusion issue. He writes the kind of thoughtless throw-away lines that the rest of the journalistic sheep bray. This from his most recent circle around the pen, "Many scientists could not reproduce those results and shot

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The Pseudoscientists of APS

Eugene Mallove and Jed Rothwell

Dr. Peter Zimmerman

Dr. John Huizenga

Prof. Robert Park

James Randi

Dr. Douglas Morrison

Photos by J.Rothwell at the APS meeting

Not all attendees at the American Physical Society's Centennial Meeting, held March 20-26 in Atlanta, Georgia, were scientists in the true sense of that word. Many of them were pseudoscientists, as their behavior proved. Some 1,000 physicists, including, we are informed, President Clinton's Science advisor, were present as three pseudoscientists took turns mocking cold fusion at a session dubbed, "Science, Junk Science, and Pseudoscience," Monday afternoon, March 22.

Jed Rothwell, who audio-recorded the entire sorry session, filed this report:

"On Monday there were three good papers on cold fusion, but I had to miss them to attend the anti-cold fusion lynch mob session instead. It featured Bob Park (Prof. Robert Park of the University of Maryland, the APS "spokesman"), John Huizenga (DOE anti-cold fusion henchman, retired), Douglas Morrison (CERN), magician James the "Amazing Randi," and a top Federal science honcho named Dr. Peter Zimmerman from the State Department Arms Control Agency. It was a trip!

"Zimmerman is conducting a *jihad* against cold fusion, vowing to wipe it out in the State Department, the Patent Office (?), and the Commerce Department with the help of the President's Science Advisor. (The Patent Office?!? And they call *us* kooks!) It was depressing and alarming, yet droll. I will describe it in detail when I get a chance. I must tell about the weirdest part here, because if I do not write it down I might think I dreamed it.

"Zimmerman gave a rousing anti-cold fusion talk, pressing all the buttons. He said that one of his first official acts was to cancel a meeting about cold fusion (Conference on Free Energy, later renamed Conference on Future Energy to be held April 29-May 1, 1999 in Bethesda, Maryland; see complete speaker listing on page 85), and 'that's one of the accomplishments I'm proudest of within the last year.' He announced that he and Park will work to exterminate every trace of CF and all other 'junk science' from the Federal establishment. They will see to it that no other meetings are held anywhere else in Washington, which is a hotbed of cold fusion as we all know. He called upon the audience to join him in this crusade, and to report to the highest authorities any rumors about unauthorized research and groups of more than three people caught discussing cold fusion. Naturally, this was met with cheers and applause from an overflow crowd there, which was a sort of sci.physics.fusion [www forum] come to life. I thought people like that only existed on the Internet.

"Anyway, here is the weird part. After the session I approached Zimmerman and asked him for the exact spelling of his name and his job title. He grabbed some papers and held them to his chest, covering his badge, and he said, 'I'm not going to tell you.' He looked like John Cleese in 'A Fish Called Wanda,' when he is caught naked in a stranger's apartment. He said, 'I am not officially here.' I asked if he planned to publish his remarks in the proceedings and he said maybe in a noncommittal tone (meaning: No Way!). Apparently he wants his statements off the record, yet he had made them in front of a cheering crowd and he saw me wearing a press badge, sitting in the front row, taking photographs and recording the lecture on audio tape!

"Does he think I plan to keep it secret? Does he think I am so dumb I will not look up his name in the conference registry or call State? Let me recap: We have a top science advisor at the State Department—an appointed official of the U.S. Government, making maybe $100 K in taxpayer's money. His proudest accomplishment so far has been to disrupt a meeting, which tells me he needs to get a life, or get a job. He boasted to 400 people that his policy is to ban discussions about cold fusion, and he wants to instigate purges in other departments, BUT he will not put this policy in writing, and he will not give a journalist his name. If that is not Alice-in-Wonderland material I do not know what is. The story is too improbable to sell as fiction.

"To me, this proves once and for all that there is no conspiracy against cold fusion. Two reasons:

1. A guy who tries to hide his name tag could not conspire his way out of a paper bag. His 'cover up' is literally a piece of paper held to his chest, to cover up. Not James Bond.

2. When you announce it is your policy to oppress a field of science to a cheering crowd of 400 [revised upward to 1,000 by Douglas Morrison's count, which in this case we gladly accept] people, and you ask them to join you, that is not a conspiracy, folks. Conspiracies are covert, this was overt (except sort of *ex-post facto* off the record). This was no conspiracy, it was a Movement, a Revival, or a Crusade. It was like nothing I have ever seen before, or ever hope to see again.

"And no, I did not snap a photo of the guy holding the paper over his name tag, but by golly I hereby claim the movie rights."

Formally, the session "papers" and then descriptions were listed as:

Session FB22 - SCIENCE, JUNK SCIENCE, AND PSEUDOSCIENCE. Three presentations:

[FB22.01] Never Get in the Way of a Collapsing Wave Function, Robert L. Park (Department of Physics, University of Maryland)

A best-selling health guru explains that his brand of spiritual healing is firmly grounded in quantum mechanics; power companies have invested millions in a device that generates energy by shrinking hydrogen atoms into a state below the ground state [Editor's note: Park is referring to BlackLight Power Corp.—see *IE* No. 17 pp. 21-35 and *IE* No. 24 pp 36-39]; half the population believes Earth is being visited by space aliens who have mastered faster-than-light travel; and chaos theory is offered as the basis of homeopathic remedies that are so dilute that not a single molecule of the medicine remains. People are eager to believe that modern physics validates quack claims. Unfortunately, they are encouraged in this belief by physicists who pander to the public's appetite for the weird.

[FB22.02] Shaping Public Ideas on Science: A View from the House, Hon. Rush Holt (Member of Congress) [Editor's note: A hot fusion physicist who was elected to Congress in 1998 (see *IE* No. 21, pg. 36). He was replaced by Peter Zimmerman]. This abstract not available.

[FB22.03] Things to Fall Down Laughing About, James Randi (James Randi Educational Foundation). This abstract not available.

Jed Rothwell continued his on-site report from the APS meeting: "Cold fusion was not the only subject discussed in this session. I think Zimmerman devoted much of his time to it, but Park and Randi spoke mainly about other things including psychokinesis, astrology, ESP, facilitated learning, and magnet therapy to

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relieve pain. Randi discussed Jacques Benveniste in detail, and he described a visit to Joe Newman, who seems to have a talent for making a bad impression on people (including me). Most of the discussions were devoted to outlandish fraud and ignorant scientific mistakes made by superstitious people.

"None of the speakers has contributed to the cold fusion literature. As far as I could tell, none of them has read the peer reviewed experimental literature. Hostility toward new ideas is inversely proportional to knowledge. Zimmerman has read some articles in *Infinite Energy* magazine. He showed a schematic from Dr. Paulo Correa's device (Editor's note: Perhaps from *IE* No. 7 or No. 8, but who knows.]; he briefly described the Mills theory, and he said that Paul Brown's nuclear battery would require impossibly large amounts of Strontium-90 if all of the energy comes from conventional nuclear reactions. This is obvious, and it is why we ran the article in *Infinite Energy* (*IE* No. 13/14, pp. 52-53).

"Zimmerman did not say anything technical about conventional palladium cold fusion. He glanced at a list of speakers from the canceled State Department meeting and said that he has never heard of Drs. Ed Storms and Michael McKubre, which means he has not read the literature. I asked Robert Park whether he has read McKubre's papers, which I had mailed him and so had Gene Mallove independently. He said, 'No, why should I? It is the same old thing, and none of it has been replicated.' The fact that McKubre is a replication of Pons and Fleischmann has not occurred to him. To him, every cold fusion claim stands alone; none reinforces any other.

"The speakers recognize no shades of grey, no spectrum of probability. As I see it, the spectrum runs from zero probability (astrology) to 100% certain (Newton's laws), with most things falling in the middle. ESP is so unlikely I would not bother investigating it [Editor's note: Gene Mallove strongly disagrees with Jed here, based on the experimental work of Prof. Robert Jahn *et al.* at Princeton], but astounding as it might seem, there is some clinical evidence that magnets may alleviate pain in post-polio cases, so I would place it low on the believability scale, but I hope someone takes the trouble to investigate it. (See *The New York Times*, December 9, 1997, "Study on Using Magnets to Treat Pain Surprises Skeptics.") Randi asked one of the magnets healers why he thought the therapy worked. The person replied that magnets might attract hemoglobin. Randi ridiculed this hypothesis at length, and showed that a living body is slightly repelled by a powerful magnet.

"It did not occur to him that a hypothesis may be wrong, but the treatment might be effective anyway. Like many skeptics, he confuses observations and hypotheses, and he rejects observations when the person reporting them has no scientific training or reasonable hypothesis. On this basis we would reject all knowledge from the prescientific era. We would assume that our ancestors must have been incapable of cooking or metallurgy because they no idea how combustion works. It also did not occur to Randi that nerves work by transmitting minute electric currents, which might conceivably be affected by mild magnetic fields. He rejected a naive and obviously mistaken hypothesis, as I would have, but he did not take the trouble to think for a moment to discover another on his own.

"After the meeting I suggested to Park that perhaps the Mills theory is wrong but the technology may be valid, because it seems unlikely that power companies would invest $10 million without first independently testing the devices. He would hear none of this. He said the power companies have been duped—they never tested anything. He said, 'I know about that, I was involved in it,' evidently as a consultant. If Park was involved and yet the power company engineers and executives went ahead with the investment anyway, they must be very confident of their results. This is the best endorsement of Mills I have heard!

"The speakers and members of the audience expressed no skeptical self doubts. They are more certain of everything than I am of anything. No one said, for example, 'Scientists can make honest mistakes.' Not one word was uttered in defense of academic freedom. Instead, they said cold fusion is fraud and it must be stamped out. Every mention of cold fusion was met with gales of derisive laughter. One person told me Julian Schwinger was either insane or senile at the end of his life. Apparently, this attitude is pervasive throughout the APS. (Schwinger quit the APS to protest its treatment of cold fusion.) One of the speakers said that a few years ago the APS gave an award to Randi. The president was initially opposed to giving the award to a magician, because he did not think science needed someone like Randi to clean house, but when he presented the award he said that Pons and Fleischmann convinced him that scientists are vulnerable and they need Randi after all.

"I did not expect a scientific presentation from James Randi, but I did go to this meeting expecting to hear the professionals say something like: 'Bad ideas in science range from outright fraud and quackery, to things like cold fusion, which died quickly in 1989.' Instead, the clock was turned back to the raucous meetings at MIT in 1989. The anger was palpable, and the audience cheered as speakers lambasted cold fusion. Many people who have worked on cold fusion and other unconventional energy were attacked. The speakers seem to have it in for Dr. Hal Puthoff and Pons and Fleischmann in particular.

"An older scientist told me he knew and once respected Ed Storms, 'but Ed knows nothing about measuring tritium.' I asked whether he thought Claytor (LANL) and Srinivasan (Bhabha Atomic Research Center) also know nothing, but he turned away and would not answer. I expected some degree of academic civility, but I saw none. I knew that Zimmerman canceled the Conference on Free Energy meeting at the State Department. I expected he would say, 'I felt this meeting was inappropriate for the State Department and should be moved to the DOE or some other agency involved with energy.' Instead, he vowed to stop the meeting at any other department. He said that he and Park would work to expose and purge anyone at the patent office who sympathizes with cold fusion. 'Bob Park will sink his teeth into that one,' as he put it." **[End of Jed's report.]**

Zimmerman introduced Robert Park, making a few prefatory remarks including, "The genesis of this session is when I began to notice, close to a year ago, that 'junk science' had become all pervasive in places where I was very much afraid to see it. On public broadcasting systems—NPR—masquerading as news on various networks every day of the week." Later, "I will shamelessly show how the First International Conference on Free Energy, now ain't gonna be held, and that's one of the accomplishments I'm proud of stopping." [applause]

"The first speaker today will be Bob Park with his witty, irreverent and almost always very accurate 'What's New' available on the web, then I'll come on after that and then we'll have James Randi, who will also be talking on pseudoscience and junk science and the like."

Robert Park touched on several topics, especially the Jacques Benveniste 'memory of water' studies and other claims of homeopathic effectiveness. Though his abstract promised a public denunciation of Mills's theory of sub-ground state hydrogen atoms, this did not happen, but he threw in what he thought was a cheap shot against cold fusion. Being a fast-talking 'smart alec' is Park's stock-in-trade:

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"It's a pleasure to be here to talk about this. James Randi and I shared a platform a few years ago in San Jose. This is an important day, this is the eve of a double anniversary, I thought I'd point that out. This is the tenth anniversary of the announcement of cold fusion at the University of Utah, but it is also the 16th anniversary of another important announcement. . . [Star Wars]. . .I calculated the odds that this was by chance...'

One realizes that Park probably understands that he is no longer capable of even beginning to address the experimental evidence in the cold fusion and new energy fields, so he resorts to cheap *ad hominems* and ludicrous, irrelevant comparisons with President Reagan's missile defense announcement.

As for having James Randi as a guest of honor at the APS Centennial meeting, following Park around from San Jose to Atlanta, what a joke that is—on the APS. When the APS has to start holding revival meetings to convince itself that cold fusion is false, then they've just about lost the battle. We must admit to feeling a bit of merriment at the antics of the APS clowns. They don't even deserve derision—they're just pathetic. The state of affairs in physics today is sorry, indeed, when physicists have to turn to tiresome magicians to mock experiments that they can't themselves disprove.

The Canceled Meeting

What got the APS pseudoscientists so riled up was the impending meeting in Washington, "COFE"—now called the Conference on Future Energy, to be held at the Holiday Inn, Bethesda, Maryland. Our scientific colleague, engineer Tom Valone of the non-profit Integrity Research Institute in Washington, DC had arranged with a State Department person for a scientific meeting to be held at the U.S. State Department on April 29-30, 1999. This meeting was to be part of a series called the "Secretary of State Open Forum." The meeting planned for the State Department was to feature a variety of scientists, engineers, and entrepreneurs who would be talking about various proposed advanced energy systems, including cold fusion, which have virtually no associated fuel costs. Other technologies to be discussed were of a more conventional nature, such as solar and wind power—also having virtually no fuel costs. Hence, the conference was called "Conference on Free Energy." Workshops were to be held May 1, 1999 at the nearby State Plaza Hotel.

Within a week of his recently joining the U.S. State Department as an advisor to the Arms Control Agency, Peter Zimmerman had apparently become intellectually offended by the content of the proposed meeting and took action to make sure that it did not occur. He quickly succeeded in getting it canceled. Later, he boasted about this in a misdirected e-mail which fell into our possession!:

Message-ID: <s6f9fcb1.092@acda.gov>
From: Zimmerpe@acda.gov
To: iri@erols.com
Subject: [Fwd: Re: CONFERENCE] -Reply
Date: Thu, 25 Mar 1999 09:06:30 -0500

Oh the shame of it all. How dastardly we were to poor Mr. Valone. He and his Aussie friend are embarrassed and it's all our fault. How can they ever forgive us? How can we ever cleanse our souls of this black mark?

Dr. Peter Zimmerman
Photo by J.Rothwell

I had a wonderful time at the Physical Society meeting in Atlanta, and you and I were hailed as heroine/hero for getting the conference moved out of State. I have reason to believe that a "Higher Power" will get them evicted from Commerce too. I will probably take a direct hit in "Infinite Energy" magazine because they sent somebody to cover the session on Pseudoscience and I was pretty scathing.

Obviously, I'm back at work.

Cheers, pete

Here are some excerpts from Zimmerman's remarks at the APS meeting:

"Let me take a few minutes to tell you about the Conference on Free Energy. Free means zero cost, it doesn't mean gives free energy. You'll notice that seminar is sponsored by the Secretary of State Open Forum and that's why I had an in to this.

"About a month ago, I took on a job as the Science Advisor, or Chief Scientist to the Arms Control and Disarmament Agency, which had been independent but will shortly be an arm of the State Department. So I'm housed in that building.

"The week before I was to start, Bob [Park] sends me an e-mail, he tells me in some detail about the content of the Free Energy under the sponsorship of the Secretary of State's Open Forum. It says, "Pete, if you can't get that killed, what's the point of having a State Department?"

"I like challenge and here was a chance to influence an event which had already taken place. A decision had been made. But, you know, I work in Washington and those of us who work in Washington are quite aware that nothing's ever finally decided until the day for it to occur has passed.

"First I should tell you that the program was sponsored by the Integrity Research Institute of Washington and here are just a few of IRI's publications.

"'Free Energy: The Race to Zero Point' a video film on VHS. This is an introductory documentary on Free Energy the race to zero point by Thomas Valone who in real life is a Master of Arts, a professional engineer and patent examiner. This should frighten you. He has a selection of energy patents, earthquake prevention and nuclear test [. . .] You know that should add some sense to it, but probably not.

"The first day I was in my new job I went to see the lady who was the current Director of the Secretary of State's Open Forum. A very nice and very sharp woman by the name of Cora [. . .]. I said, 'Cora you have a problem.' Her answer to me was, 'Do you know somebody named Richard Garwin.' [Editor's note: A DOE cold fusion panel member in 1989.] I said, 'Yeah I know Dick, why?' She said, 'Because fifteen minutes ago he put a message on my voice mail which said, Miss [. . .] you have a problem."

"It didn't take a great deal of effort as a physicist to show that in all probability a conference on free energy was not something that the Secretary of State wished to endorse. I don't know why. . .

"They will tell you they're not theorists, we're engineers and [. . .] we do what works. We're not always sure we can explain, but we try to do what works. Well if a megacurie for 10 milliamps is what works. If you know how to do one over 10 squared.

"I got to show you this picture anyway. This is a Correa machine. . . the discharge passes between two. . .and the electrodes at the end are from information in *Infinite Energy* magazine, this is one of the sources of new energy. Apparently there is an abnormal glow discharge, in other words the system starts pulsing. Well, of course, once it starts pulsing you know what it produces - cold fusion.

"That's the answer. They call it table top nuclear transmutation, they have all kinds of names for it. So far as I have been able to tell from everything Tom Valone has sent me I couldn't find except one paper which discussed accelerator-based transmutation as a way to get rid of radioactive waste that made any sense. It may not be economical, it may not work, but it is certainly a piece of modern physics that passes the snicker test and that's one of the problems. They always manage to mix in a few things which do pass the snicker test and they shelter it in the harbor of the few things like wind power and accelerator transmutations. They use that as cover.

"So you see, they're legitimate, you agree they're legitimate. They're fringe, nobody's demonstrated that yet so we're legitimate. I am appalled to think that as the 20th century draws to its end two years from now that we are still seeing nonsense like that and we have very little defense. And we, as scientists, don't do a damn thing very often to stop it. Well, I decided that it stops as far as I can help it with me. The Physics in Society is going to be putting out, in the next couple of months, a web page on this. We're going to try to do a project in which we collect information about junk science funded one way or another, either for publicity purposes or anything else and we're trying to go after it whatever way we can. I hope that all of you will help.

"And now I have to admit that all the work I did to get this conference killed at the State Department is probably [. . .] because you see Mr. Valone works at the Patent Office and has failed to [. . .]every schedule of the Commerce department. I don't know anybody in Commerce to get burned yet, but many people I talk to do. And I'm hoping that Commerce will give them as warm a reception as the Department of State did.

"I'll take a few questions if there are any . . ."

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A Question for Skeptics of Any Kind

Edmund Storms
2140 Paseo Ponderosa
Santa Fe, NM 87501

Science grows by competition between two possibilities. One is based on a very imperfect imagination for new possibilities. The other is based on a tested understanding of our world which we all agreed to enjoy without conflict. Each has its role in intellectual evolution and its strengths. However, to function properly, the relationship needs to be based on mutual respect, as is the case with all relationships. This respect leads to questions not declarations, to discussion not conflict, and to seeking a mutually satisfying goal, not an arbitrary conclusion. In the cold fusion partnership, these requirements are not being followed and, as a result, the marriage is on the rocks.

People who view this marriage from the outside are confused, as is frequently true of all marriages. Articles describing the relationship try to be fair by quoting both sides. However, this is done with an assumption that the quoted skeptics are objective and honest, while people making the strange claims may be delusional. Forgotten is the fact that skeptics can be deluded and self-serving as well. Indeed, in the history of science, skeptics have been wrong more often than they have been correct. As with all marriages, both can be wrong and right at the same time.

Since Pons and Fleischmann made their discovery, people have been given permission to use their imaginations to see nature in a different way. Some of these views will be faulty. It is the role of the skeptics to point out these flaws. Unfortunately, the skeptics have taken over the relationship and have denied their partners permission to explore anything. The marriage is strained and will soon lead to divorce. Divorce comes, as do many divorces, when a more attractive offer comes along. In this case, people with money, with no loyalty to conventional thinking, are heard to say, "I will support and love you if you follow me." When this happens, the skeptics will be left alone in their narrow world, looking like fools, while the other partner goes out to explore the exciting new world. As skeptics, is this the way you want to be remembered by the children of science, by *your* children?

❖❖❖

EXPLOITATION OF GRAVITY FIELD ENERGY

Thomas Valone
Website: www.erols.com/iri

With the sudden passing of Dr. Hans Nieper, as mentioned in *IE* No. 23, pg. 51, the article that follows has been reprinted. It is about Dr. Nieper's coordination of his first conference in Hannover, Germany in 1980. It may have been the first Free Energy Conference in the World. This article was written in 1981 following this unusual conference at which I was invited to be a speaker. It was the beginning of my free energy career, which has continued to this day. It is with gratitude that I offer this reprint in honor of the late Dr. Nieper. A full report on the conference and the follow-up conference in Toronto, Ontario is contained in his book, *Revolution in Technology, Medicine and Society*, (MIT Oldenburg, ISBN 3-925188-07-X).

Bruce DePalma, inventor of the N Generator, has asked me to describe my experiences at the Germany Symposium of Gravitational Field Energy (November 27, 1980) for *Energy Unlimited*, No. 9. I will try to be candid about what probably was the most progressive conference ever held concerning energy technology.

The Speakers

My first encounter, the day before, involved the amiable coordinator, Dr. Hans Nieper, and the group of speakers. Dr. Nieper, it turns out, is a cancer doctor who is famous for his successful Laetril treatments.[1] The group of speakers were Dr. Nieper, Rudolph Zinsser, Dr. Shinichi Seike, Richard Kinnegar, Joachim Kirchhoff, Adam Trombly, along with the entrepreneur, Dr. John Raiford, and myself.

As I was introduced to Dr. Seike, in the lobby of the Hannover Intercontinental Hotel, I found myself grasping his business card instead of his hand. Dr. Seike is a bit eccentric but he is a good physicist as I found out in the next few days.

He spoke to me about the gravitational effects of Nuclear Electronic Resonance which no one in this country has explored. Usually we physicists look at NMR (Nuclear Magnetic Resonance) only, when the nucleus is explored.

Rudolph Zinnser: At dinner, Adam Trombly and I were interrupted by Dr. Nieper re-introducing Rudolph Zinnser as

Gravity continued on page 59

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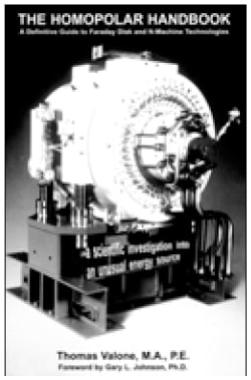

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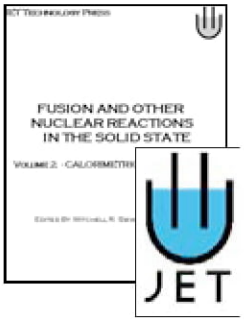

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DEVICE AND PROCESS TESTING UPDATES

Conducted by Ed Wall and Eugene Mallove

Les Case Catalytic Fusion Cell

A cell that is derived from the work of Les Case has recently come into prominence. Russ George claims that it is "a large improvement on the work of Les Case and others" who have shown cold fusion evidence using catalytic type materials. In April, Russ George of Saturna Technologies, Inc. released a report on what may be one of the most important new cold fusion experiments ever conducted. The experiment was performed at SRI International, but SRI staff are not signatories to the report. The experiment reveals a monotonically increasing ^{4}He concentration over a 28-day period in a cell modeled after that of Les Case (see *IE* No. 19 and following issues). The helium concentration rises to 11 ppm, which is over twice the ambient atmospheric level of 5.22 ppm, thus appearing to rule out external leakage contamination. This device has palladium-doped activated carbon catalyst in a heated deuterium atmosphere. The full paper may be obtained at:

http://rsrch.com/saturna/APSpapers_1998_1999.htm.

Readers are urged to read George's report, which shows a control cell running concurrently with the active cell, showing only background helium levels (≤ 0.5 ppm).

We are further encouraged to learn why perhaps Earthtech International's and our more limited attempt at replication have not shown excess heat. (Visit: http://www.eden.com/~little.) As Vortex forum contributor Horace Heffner observed, "It looks like George used good control means, so it is really an issue of further replication at this point, I think." On Friday, April 9, 1999, on a nationally broadcast program on NPR with Russ George, hot fusion scientist Michael Schaffer of General Atomics praised the Russ George experiment as worthy of replication by many people. Indeed, replication is the key to acceptance of new energy phenomena, as we believe that the proof already exists, just not to everyone's satisfaction.

We initially obtained a small cell from Dr. Les Case, made from a World War II surplus oxygen bottle, which was demonstrated at NERL to produce excess temperature (see *IE* No. 19). Case's mantle heater was used, which covers most of the cell, but it left the top uncovered. Later on, in our efforts to perform accurate calorimetry—not just temperature measurement—we placed the same cell in the bottom of a large Dewar, and put a lid on the top. We were able to get very stable thermocouple temperature readings in the catalyst thermo-well and on the exterior of the cell. We were able to vary these temperatures with different heater input powers, which would make for credible calorimetry.

However, even after many tries, we saw only hints of transient excess temperature in the heavy hydrogen run, compared with an ordinary hydrogen (protium) test. We believe now that this was a case of the measurement method destroying the process to be measured. Also, the many heating cycles that the cell underwent with hydrogen inside caused stress corrosion cracking of the cell wall, making it useless for further experimentation. Dr. Case graciously gave us another cell—one that had not been modified to a reduced-size chamber with a leak-prone perimeter weld.

In trying to reproduce the same conditions that Case uses, we replaced an older, less capable vacuum pump with a newer model; we used the same quantity of catalyst material; and we matched the previous gas pressure and catalyst temperature. But we had not yet worked with a *thermal gradient* across the catalyst. This Dewar calorimetry method was not suitable for producing adequate thermal gradients. So, we put these attempts on hold, until another idea came along. Instead of putting the cell in a closed Dewar, we placed the cell on its external heater in a chamber which had air temperature tightly regulated. Of course, the heater had to run much hotter than in the Dewar to get the same catalyst temperature. The thermal gradient across the catalyst was much greater and with a fixed ambient temperature, the wall and catalyst temperatures would be quite stable. But something very strange was observed. The slight variation in ambient air temperature seemed to be amplified in the catalyst temperatures. Using ordinary hydrogen in the cell, the ambient temperature would vary by 1°C over twenty-four hours and the catalyst would vary 4°C, tightly correlated with the ambient variation. A 4°C variation in catalyst temperature is unacceptable if we are trying to establish a credible ΔT excess temperature observed with deuterium over that of protium.

Now we have returned to using the Dewar, without a lid, much like what photos of Dr. Michael McKubre's (SRI International) and Russ George's equipment show. This increases the "thermal mass" of the system, so the time to steady state conditions is long, but temperatures are more stable.

In another initiative, with the help of engineer Jeff Driscoll of Quantum Energy Technology, a new design for a cell has been developed that employs a ConFlat-type metal-on-metal seal. The goal is to produce, at reasonable cost, a cell that can contain helium for extended periods and will stand up well to hydrogen. Stainless steel 316L or 318 are recommended; welding is not recommended. Helium is notoriously difficult to contain, even worse than hydrogen. If this design works out as a demonstration cell of the Case catalytic process, investigators could employ certified labs to determine helium concentration and ^{4}He/^{3}He isotope ratio in a method that could achieve widespread replication.

Versatile Water Flow Calorimeter

Scott Little of Earthtech has developed a fairly simple water flow calorimeter (VWFC), which does not require calibration because it recovers virtually all of the heat generated by the device under test (DUT). This first came under serious attention when we were having problems using the water flow calorimeter provided with the Cravens-Letts cell described in this column in *IE* No. 24. That calorimeter does not have reliably high heat recovery in the water cooling loop. If modest excess heat were indicated, it would be in doubt—in part also from the issue of insulation variation between adjustments, which proved to be very frustrating. The as-received Cravens-Letts calorimeter had inadequate inlet water temperature regulation, which could cause misleading data. We learned that Dennis Letts was actually using Scott Little's water flow calorimeter in studying his cell, because of its reliability and well-controlled inlet water temperature regulation:

http://www.eden.com/~little/vwfc/vwfc.html

Consequently, we decided it would be very worthwhile to build a similar VWFC, which we thought would be fairly easy, given the great advice that Scott Little has provided, but this was not the case. Our HP 34970A data acquisition system

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was not the case. Our HP 34970A data acquisition system comes with proprietary software (in HP VEE) that will not allow the controlling PC to be used for anything other than communicating with the data acquisition system. This means that it cannot be used to control the temperature regulation of the inlet water heater/cooler. Ed Wall decided to attempt building an analog controller for regulating the inlet water temperature. That also is proved more difficult than anticipated.

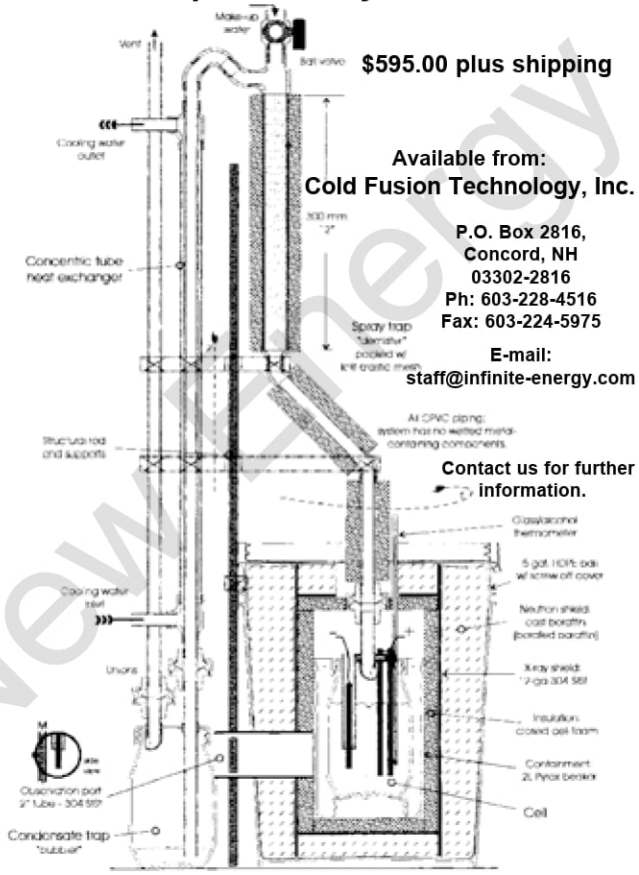
We anticipate that once we have a working VWFC with good heat recovery, the measurement of heat from the Cravens-Letts cell and the Case cell could be accomplished with great reliability and accuracy.

Plasma Discharge Electrolysis Cell, Continued Analysis

We are still fascinated by the high concentration of calcium (229 mg/l) measured in the cell filtrate. We have now had every cell component tested for calcium content, except the commercially distilled water that was used in the apparatus. This includes the potassium carbonate, the ceramic insulator used for holding the carbon rod, and the PVC fixture, as well as the carbon rod. None of these can account for the calcium in the filtrate. We provided a calcium analysis of the carbon rods, the filtrate, and the detritus in *IE* No. 24 p. 35. Going further, we had an outside lab test the as-received K_2CO_3 powder and found it to contain Ca at only 6.1 mg per kilogram. The ceramic insulator holding the carbon cathode was tested and found to contain Ca at only 23 mg/kg.

We are planning to do a repeat series of runs using deionized distilled water provided by the testing laboratory, taking increased precautions against contamination. If we can achieve high calcium concentration repeatably, and perhaps observe Ca concentration build-up as a function of run time, this would be further evidence toward establishing Ca as a transmutation product (perhaps from the potassium in the electrolyte). Isotope assessment of the calcium could help nail down this conclusion.

Plasma-Discharge Electrolysis Exploration System



$595.00 plus shipping

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P.O. Box 2816,
Concord, NH
03302-2816
Ph: 603-228-4516
Fax: 603-224-5975
E-mail:
staff@infinite-energy.com

Contact us for further information.

Tenth continued from page 22

down the experiments as sloppy and/or delusional science."

Siegel will not spend more than thirty seconds—no exaggeration—listening to technical arguments or data from experiments, before he blusters again about his deadline and demands a pungent sound bite. It might be some sort of attention disorder. More likely, it's just conventional journalistic stupidity.

The front page article featured a large color photo of Hal Fox in his lab at Trenergy, Inc., but it made disparaging remarks about financial difficulties and Hal as one of the "last vestiges of cold fusion in Utah."

He did print some of my "sound bites": "There is absolutely no doubt cold fusion is a real energy source," Mallove said. "The crackpots are all in the mainstream science establishment who attacked cold fusion without examining the evidence. The scientific establishment was conned into thinking there was no evidence for cold fusion. This is one of the greatest frauds in the history of science." That was meant for the obtuse folks at the University of Utah Physics Department—especially for Michael Salamon, MIT's alter-ego there, if he is, still inhabits the place. Ditto for Steve Jones at BYU. Siegel refrained from printing my comment about the ethics of turncoat, failed scientist Jones. It might have been, "too hot to handle."

Siegel quoted physicist Craig Taylor, physics department chairman from 1989 to 1998: "It's still nonsense after ten years. . . The difficulty with cold fusion is the same as it was in the beginning. It just violates too many physical laws to be plausible." He doesn't know Science 101—department chairman or not.

Siegel quotes Taylor as thinking that the supportive evidence comes "from nuts to people whose scientific judgment maybe isn't as sound as it should be." The pot calls the kettle black.

Prof. Peter Stang, head of the University of Utah Chemistry Department since late 1989 (presently dean of the College of Science), was quoted by Siegel, "I do not dispute the fact that Pons and Fleischmann were and are reputable electrochemists." But Stang apparently can't believe that "any legitimate scientist" still "believes" in cold fusion. Siegel quotes him, "There may be some yet ill-understood [chemical] phenomenon going on here, but it probably has little if anything to do with nuclear phenomena." Stang knows from nothing. He should have known better than to shoot his mouth off about something he has apparently not been following. Stang's nonsense is "par for the course" behavior for what passes today as "science" in academe.

"Few Scientists Still Seeking Cold Fusion,"
by Alexandra Witze, *The Dallas Morning News*, March 23, 1999.

This bland piece, which follows the standard science journalist "party line" emblazoned in its title, adds very little information about anything. It does have a less than charming ending line provided by John Huizenga: "In terms of scientific fiascos, I think this [cold fusion] is at the top of the list." That is Mr. Fiasco himself talking.

If we have the room and stomach for it, in Issue No. 26 we'll provide more of the journalistic pap that surrounded cold fusion's tenth anniversary. Remember, it's for history.

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COMPILED BY EUGENE MALLOVE

ARCO's CEO Bowlin Sees End of Oil Age

A dim light of awareness is apparently dawning in at least one oil company's boardroom. We received this press release from ARCO, one of the world's largest oil companies. It even speaks cryptically of "new energy technologies":

FOR IMMEDIATE RELEASE, FEBRUARY 9, 1999:

ARCO CHAIRMAN SAYS LAST DAYS OF OIL AGE HAVE BEGUN: CALLS ON U.S. ENERGY INDUSTRY TO MEET CLEAN FUEL CHALLENGE

[HOUSTON] The twenty-first century will bring a dramatic "new look" to the U.S. energy industry, with cleaner-burning natural gas and renewable motor fuels playing decisive roles in the energy mix of the future, ARCO (NYSE:ARC) Chairman and Chief Executive Officer Mike R. Bowlin told a meeting of industry leaders here today.

Speaking at the Cambridge Energy Research Associates' 18th annual executive conference, Bowlin said the world is entering "the last days of the Age of Oil," and the energy industry must respond wisely or face the consequences.

Chief Executive Office
Mike R. Bowlin
Photo courtesy of ARCO News

"Global demand for clean energy—natural gas, renewables, electricity and new energy technologies—will grow faster than overall demand for energy, including oil and coal," said Bowlin, who heads the nation's fifth largest oil and gas company.

"Ten or fifteen years from now there still will be a large and healthy market for oil—of course. We hope that it would be a healthier market than today. But it is also true that the market share for oil will diminish, as the demand for other forms of energy grows." The energy equations of the twenty-first century, focusing on alternative fuels, will leave oil and gas companies with a critical choice, said Bowlin: "Embrace the future and recognize the growing demand for a wide array of fuels; or ignore reality and slowly—but surely—be left behind."

Bowlin predicted that natural gas, which he described as "a still underappreciated energy source," will be vital for economic growth in the developing world. He described ARCO as "a believer in an expanding role for gas in Asia" where liquefied natural gas (LNG) may account for up to a tenth of total energy demand by 2010. "We all have a stake in a prosperous society and a clean environment," said Bowlin. "To ensure both, our industry must be able to deliver a competitively priced product that meets the demands of our customers and government." Bowlin called on the energy industry to join automakers in a major new effort to develop clean fuels. "Working cooperatively with the autos to determine the most cost-effective combination of vehicle and fuel technologies is the key to achieving our mutual goals," Bowlin said.

As an example of industry initiative, he cited ARCO's role in developing reformulated gasoline in California, where ARCO is headquartered. In 1989, ARCO introduced the world's first cleaner-burning gasoline, EC-1, at its Los Angeles-area stations. Ultimately, reformulated gasoline was mandated for all of the state. "The issues of the day—while demanding our attention—should never prevent us from planning for tomorrow," Bowlin said. "I believe that the energy industry of the 21st Century will be more competitive, more diverse and more dynamic than today. The challenge is not merely to survive today's low prices, but to plan for a future in which hydrocarbons are just one of a wide variety of fuels that will build the global economy of the twenty-first century."

ARCO is a worldwide integrated hydrocarbons corporation with operations encompassing all aspects of the oil and gas business: exploration, production, refining, and marketing of crude oil, natural gas, and natural gas liquids. ARCO has significant operations on the North Slope of Alaska and in the Western United States, Gulf of Mexico, China, Indonesia, and the United Kingdom North Sea.

For further information: William Warren or Linda Dozier (213)-486-3384.

ANNOUNCEMENT:
Fourth Workshop on Anomalies in Hydrogen/Deuterium Loaded Metals

The Fourth Workshop on Anomalies in Hydrogen/Deuterium Loaded Metals has been scheduled for October 22-24, 1999, near Asti, Italy. The event will be held at the Hotel Villa Riccardi, located at Via al Monte 7, Rocca d'Arazzo (AT). The entire hotel is already booked for the evenings of October 21-23 and can be reserved via the organizers. Accommodations will cost attendees about 45,000 lire per night (about $25).

This year there will be a workshop fee of 250,000 lire as a contribution towards meals, which will be provided by the organization. All participants will receive a copy of the Proceedings of the Third Workshop, published by the Italian Physics Society. Regardless of the introduction of the workshop fee, the cost of attending may be even lower than in previous years due to lower board and accommodation costs.

If you would like to present a paper, book a room, or simply attend the workshop, contact Bill Collis as soon as possible at mr.collis@physics.org, as space is limited. Check out the website for the latest details (www.netcity.it/coldfusion).

NASA Anti-Gravity Research Grant

Phase I—Press Release

[COLUMBUS, Ohio] - April 13, 1998 - Superconductive Components, Inc. (OTC Bulletin Board: SCCI) today announced that it has been awarded a Small Business Innovative Research (SBIR) grant by the National Aeronautic and Space Administration (NASA) to develop a process to manufacture large superconductive discs for use in gravity modification experiments.

The program, titled "Demonstrate the Feasibility of Fabricating a Dual Microstructure YBCO Toroid Suitable for Gravity Shielding Experiments," links Superconductive Components, Inc. (SCI)

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with NASA and the Oak Ridge National Laboratory. The Phase I award of $70,000 will fund work to be done at SCI to modify its existing processes to develop a superconductive toroid with a very specific microstructure. Work published by Russian scientist Eugene Podkletnov suggests that a YBCO disc with specialized features may be able, under laboratory conditions, to shield gravity waves. Phase II of the program, if approved by NASA, could be funded up to $600,000. Approximately one half of NASA Phase I awards result in Phase II contracts.

"We are pleased to have been selected by NASA through its peer review process, to do this work," said SCI Vice President, J.R. Gaines, Jr. "This award is a great acknowledgment of our technical strengths in YBCO Melt Texturing and the overall capability of our team. We are hopeful that this SBIR, which allows us to work closely with NASA on an extraordinary topic, will lead to significant technical breakthroughs, resulting in ongoing research and commercial sales."

The concept of Gravity Modification has been investigated by NASA and others for several months and has been the subject of a recent documentary by German public television. International attention has been focused on these experiments because the shielding of earthbound objects from the effects of gravity may radically alter the economics of space travel and transportation in general.

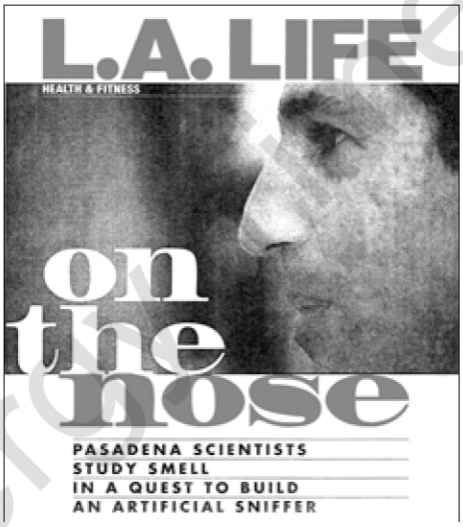
Superconductive Components, Inc., head-quartered in Columbus, Ohio, manufactures ceramic superconductors for wire, electronic devices, such as cellular base stations, and frictionless bearing systems for energy storage and other rotating machinery. The company sells its product in the U.S. and over forty foreign countries. For more information contact J.R. Gaines, Jr., Vice President, at 614-486-0261.

Ed. Note: We have been notified via press release that on January 19, 1999, Superconductive Components, Inc. (SCCI) was awarded a *Phase II* SBIR contract to develop a YBCO toroid suitable for gravity shielding experiments, as described above. With this new $600,000 contract, SCCI will collaborate with Dr. Podkletnov and also the Electromechanics and Superconductivity Applications Section of the Energy Technology Division of Argonne National Laboratory. The project is planned to be completed in twenty-four months.

We note with delight that *Discover* magazine, May 1999, has a fine two-page article by Corey Powell on the NASA antigravity initiative, pp. 31-32. (See also the article by Chris Tinsley in *Infinite Energy*, No. 9, pp. 49-50) Dr. Ning Li at the University of Alabama, who is doing the experimental and theoretical work on antigravity, is quoted, "...it could change everything...Current industry would vanish from the face of the Earth!" And Corey Powell notes, "A practical antigravity device could allow rockets without propellant or power plants that run without fuel."—*EFM*

Only the Nose Knows—Caltech Smells Again!

On March 1, 1999, the *Daily News* of Woodland Hills, California published a glowing syndicated account of the new research by that genius of Caltech, Prof. Nathan Lewis. The article said that ten years earlier, Lewis had "led a team that handily debunked the myth of cold fusion." The article was titled, "Mission: proboscible—Chemist on scent of new ways to track what the nose knows."



After the traditional cheap-shot against cold fusion in the lead, to build up Lewis's reputation as a forty-three year-old wunderkind, writer Usha Lee McFarling summarizes Lewis's current work: ". . . Lewis is busy untangling the chemical riddle of smell—an achievement that could have large economic and social consequences. His goal is to create artificial noses so small, so sensitive, and so cheap—less than $1 a nose—that they will be as ubiquitous as computer chips."

Dr. Melvin Miles of the U.S. Navy, one of the foremost cold fusion researchers (who lacks now even *naval* funding for cold fusion while lavish *nasal* funding goes to the vaunted Lewis), took strong exception to the notion that Lewis had "debunked cold fusion." In fact, it seems that cold fusion has debunked Nate Lewis.

Here is Dr. Miles' letter to the newspaper, copied to Lewis and others. We'd say Miles' letter is right on the nose and that the article published by the *Daily News* stinks!

From: Melvin H. Miles, Ph.D.
Chemistry and Materials Branch
Research and Technology Division
Code 4T4220D
Naval Air Warfare Center Weapons Division
China Lake, CA 93555-6100

To: Daily News Public Forum
P.O. Box 4200 Woodland Hills, CA 91365-4200

March 7, 1999

Dear Public Forum:

I read with interest your recent article regarding Professor Nathan Lewis and his quest for an artificial nose (*Daily News*, L.A. Life Section, pp. 3-4, March 1, 1999).

Regarding the first paragraph about Professor Lewis' background, I strongly object to your statement that, "A decade ago, he led a team that handily debunked the myth of cold fusion." The actual facts are that cold fusion research continues, and that I and others handily debunked his research results on this topic (see for example the *Journal of Physical Chemistry*, Vol. 98, pp. 1948-1952, 1994). Professor Lewis has never replied to the various errors that I and others exposed about his research and to the fact that his results actually support the cold fusion claims of excess heat. The Seventh International Conference on cold fusion was held April 19-24, 1998 in Vancouver, Canada; the Intersociety Energy Conversion Engineering Conference held August 2-6, 1998 in Colorado Springs contained a cold fusion session, and the prestigious American Physical Society meeting in Atlanta will have a session relating to cold fusion on Friday, March 26, 1999. The web location for the abstracts of the session in Atlanta is the following:

http://www.aps.org/meet/CENT99/BAPS/abs/S9500.html

Cold fusion is obviously not a debunked science as claimed in your article, but progress is slow since we do not yet understand this new phenomena.

As a taxpayer, I hope Professor Lewis' government funded work on an artificial nose is a vast improvement over his flawed escapade into cold fusion.

Sincerely,
Dr. Melvin H. Miles
NAWCWPNS Fellow

cc: Usha Lee McFarling, *Knight Ridder Newspapers;* Professor Nathan Lewis, California Institute of Technology; Professor Martin Fleischmann, U.K.; Dr. Eugene Mallove, Editor, *Infinite Energy ;* Professor Mostafa A. El-Sayed, Editor, *Journal of Physical Chemistry*

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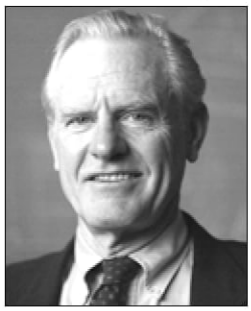
Prof. Henry W. Kendall, MIT Physics Nobelist, Dies in Diving Accident

Prof. Henry Kendall of MIT died accidentally on February 15, 1999 while on an underwater photography expedition in Florida. Kendall, 72, was a resident of Sharon, Massachusetts.

Dr. Kendall, MIT Prof. Jerome Friedman, and Dr. Richard Taylor of Stanford University shared the 1990 Nobel Prize in Physics for experimental work at Stanford Linear Accelerator (during 1967-1973) that was said to confirm the existence of previously hypothesized quarks, the subnuclear constituents of protons, neutrons, and other particles.



Prof. Henry Kendall
Photo: MIT News Office

Dr. Kendall helped found the Cambridge, Massachusetts-based Union of Concerned Scientists in 1969, and led it since 1973. The UCS has opposed fission-based nuclear power, warned of the consequences of global warming from carbon-dioxide build-up and attacked various military programs, such as "Star Wars" missile defense. On the subject of cold fusion, it has largely remained mute. It has consistently ignored reports of cold fusion research and commercial development—even when such information was handed to the group at conferences, and via mail at least six times per year since 1995.

The irony of Nobel laureate Kendall's death is that it ended in water, which as the cold fusion and new energy fuel of the future will solve so many of the problems for which he devoted much of his latter days. We wish that Dr. Kendall had been able to use his stature, prestige, and following to support the investigation of cold fusion.—*EFM*

Noble Laureate Glenn T. Seaborg, Dies at 87

Chemistry Nobel Laureate Glenn T. Seaborg died February 25, 1999, shortly before his 87th birthday. He was born in Ishpeming, Michigan, April 19, 1912. He will long be remembered for his accomplishments in education, and the development of peaceful nuclear fission power—also because his name is immortalized in element Z = 106, seaborgium (See *Infinite Energy*, No. 15/16, 1997).

Seaborg won the Nobel Prize in Chemistry in 1951, which he shared with Dr. Edward McMillan, for work on the transuranic elements, ten of which he discovered—plutonium among them. Seaborg worked on the Manhattan atomic bomb project in World War-II and later chaired the U.S. Atomic Energy Commission (1961-1971).

Nobel Laureate Glenn T. Seaborg
Photo courtesy: Lawrence Berkeley Laboratory

Isaac Asimov notes in his *Asimov's Encyclopedia of Science and Technology* that Seaborg was elected president of the AAAS (American Association for the Advancement of Science) in 1970, "but only after much opposition," from those who condemned his role in the development of fission nuclear power. Unfortunately, a mere three weeks after the Fleischmann-Pons announcement, on April 14, 1989, Seaborg told U.S. President George Bush in the Oval Office of the White House, "It is not due to nuclear fusion." Seaborg's opinion on the topic of cold fusion remained unchanged to the end. —*EFM*

Gee Whiz! Table-Top *Hot* Fusion!

Most science journalists may have ignored or disparaged cold fusion around its tenth anniversary, March 23, 1999, but many of them dutifully reported the news about a new kind of *hot* fusion experiment—one that, like cold fusion, sits on a table-top.

Scientists at Lawrence Livermore Laboratory reported triggering hot fusion activity in clusters of deuterium atoms that were bombarded with laser light pulses (20 femtosecond duration). Livermore physicist Todd Ditmire announced his findings at the American Physical Society meeting in Atlanta, Georgia on—you guessed it—March 23! Each laser light pulse released about 10,000 hot fusion neutrons, it was said, when the laser beams hit small clusters of deuterium atoms.

The ABCNEWS.com website reporter Kenneth Chang wrote, "Cold fusion faded under scientific scrutiny. But fusion on the tabletop, with its more modest possibilities, looks like a reality." The article also touted the fact that this experiment "only" cost $1.2 million, compared to the $1.2 billion being spent on the Nation Ignition Facility laser fusion monster at Livermore. And, best of all wrote Chang, the device will not produce "limitless energy". . ."at best the device might produce a stream of neutrons useful for nuclear research."

The new hot fusion achievement was also touted by Charles W. Petit in *US News and World Report* (April 5, 1999, p. 58). He assured his readers, "It's not cold fusion, another small-scale method that caused a sensation ten years ago until most scientists concluded it was bogus."

Graphics accompanying this article contained the cartoonish words: "Wow! It really works! No joke! Your guide to tabletop fusion! Be the envy of your physics lab!" The real joke in this article is the ostrich-like "science journalist" Charles Petit himself, who has been ignoring cold fusion for ten years and who couldn't resist using a favorite whipping boy—cold fusion—to tout the latest energy technology dead-end coming out of the Livermore hot fusion La La Land.

From the BBC: Tuesday, March 23, 1999

"Should the cold fusion dream die?" by BBC Science Editor Dr David Whitehouse "Cold fusion has had only a tiny fraction of the effort and resources that have been lavished on "hot" fusion research. And we have had virtually no return on that investment. We should give the cold fusion camp time and encouragement. We live in a fusion universe."
For story:
http://news.bbc.co.uk/hi/english/sci/tech/newsid_301000/301893.stm

Progress is impossible without change, and those who cannot change their minds, cannot change anything.
George Bernard Shaw

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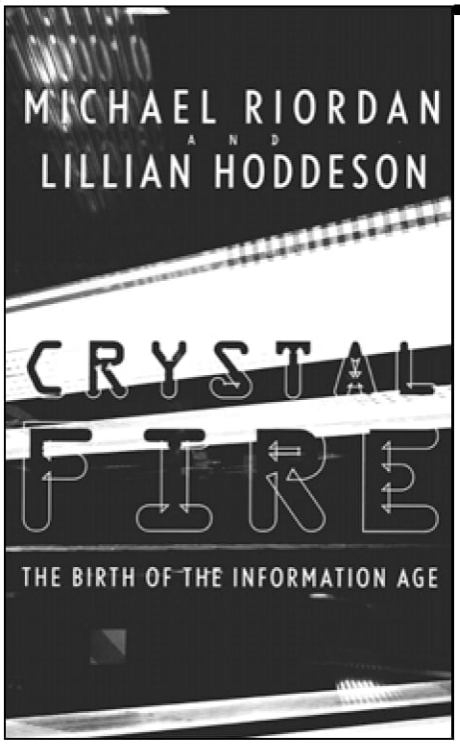
Transistors and Cold Fusion – Part 1

Jed Rothwell



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by Michael Riordan and Lillian Hoddeson

Much of this paper is based on the book *Crystal Fire*,[1] a good introduction to the history of semiconductors.

The history of transistors teaches many lessons about how cold fusion might develop and what should be done to help it along.

Transistors are physically similar to cold fusion devices. In fact, some of the earliest experimental transistors were immersed in electrolyte with a counter electrode to neutralize the surface barrier.[2] Transistors and cold fusion cathodes are both small, low- temperature, solid state crystalline devices that replace large, hot, plasma or vacuum-state devices—triode vacuum tube amplifiers and tokamak reactors. Many of the specific hurdles overcome by early transistor researchers are directly applicable to cold fusion, especially problems with reproducibility, contamination, and materials. George Miley[3] and others think that commercial cold fusion cathodes may be fabricated by using modified semiconductor manufacturing equipment, especially thin-film or electroplating apparatus. Cold fusion cathodes do not require precise placement of components the way integrated circuits do, but they do require precise control of materials and composition, extreme cleanliness, automated production, and packaging in plastic or ceramic containers to exclude contamination.

Transistors and cold fusion were developed after decades of theoretical speculation, false starts, and precursor devices. Paneth and Peters conducted cold fusion experiments with palladium in the 1920s; J. E. Lilienfield received a patent for a semiconductor field-effect amplifier in 1930, which probably would not have worked. Development of both transistors and cold fusion was delayed for years because there was no broad theory to guide research, and basic questions remained unanswered. Until 1952 it was not clear whether the transistor effect occurs in the bulk of the material or on the surface, and this is still a major unanswered question in cold fusion. Fleischmann believes the effect occurs in the bulk, but most other scientists say it happens at the surface or near surface layers. They point to evidence such as damage found near the surface and the fact that helium and tritium are generally found in the effluent gas, not trapped in the metal lattice.

Cold fusion has been far more controversial than semiconductors, and more difficult to replicate, but semiconductors did cause controversy during the first twenty-five years of development. In 1931, Wolfgang Pauli said: [4]

> I don't like this solid state physics . . . though I initiated it . . . One shouldn't work with semiconductors, that is a filthy mess; who knows whether they really exist.

Problems with Contamination and Reproducibility

Difficulties with contamination have always plagued the semiconductor industry, and they are major problem in cold fusion. Minute quantities of impurities, called dopants, must be added to silicon to make a transistor. Other impurities must be rigorously excluded, because they poison the reaction. It is likely that similar dopants enhance the cold fusion effect.

Before there was a theory, the only way to begin learning how to make an effective semiconductor amplifier was to look at samples of solid state material that did things similar to amplification, like rectifiers and photovoltaic converters. Subtle differences in materials were important. Copper oxide rectifiers worked best when made with copper from a particular mine in Chile. In 1938, a piece of silicon that acted as a photovoltaic device was discovered fortuitously. The chemical makeup of this sample was investigated with the best mass spectroscopy available at the time. Since cold fusion scientists have no effective theory, they should concentrate on examining and analyzing materials from effective cathodes.

One of the myths spread by opponents of cold fusion is that soon after things are discovered, they become easy to reproduce. Transistors were extremely difficult to reproduce for many years. One scientist recollected, "In the very early days the performance of a transistor was apt to change if someone slammed a door." In the mid-1950s transistors cost $16 apiece compared to the $3 vacuum tubes they were designed to replace. Integrated circuits were even worse. In the 1980s, after three decades of the most intense high-tech R&D in history and hundreds of billions of dollars of investment in transistor technology, more than half of the computer chips coming off production lines in the U.S. were defective and had to be scrapped. (Production rates were better in Japan.) In the late 1990s, 10 to 20% of chips fail.[5] I will have more to say about this in Part 2.

Riordan and Hoddeson describe contamination problems seven years after intense semiconductor research began: [6]

> For several years during the early to mid-1950s, Shockley (and others) spoke of a mysterious class of substances that he dubbed "deathnium," which somehow crept into semiconductors and acted as traps for holes, gobbling them up and further shortening their already-too-brief lifetimes. After much consternation and head scratching, trace atoms of copper were finally identified as one of the culprits. They were thought to have found their way from laboratory doorknobs to germanium surfaces on the unwashed hands of unwitting technicians!

An Educated Guess About Crystal Grain Size

Most metals are made up of randomly oriented microscopic crystals (also called crystallites or grains). Metal with many small grains is harder than metal with fewer, larger grains. A blacksmith heats iron to reduce the number of grains by melting them together, making the iron malleable. Then he pounds

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it with a hammer to increase the number of grains, making it more amorphous or polycrystalline. Some materials, such as gems, are made of a single large crystal. In 1948 it was discovered that a transistor made from a single crystal of germanium, with no grain boundaries, worked much better than amorphous germanium, because grain boundaries interfere with the transport of electrons. Cold fusion works best the other way. Recent work by De Ninno *et al.* shows that cold fusion cathodes work better with small grains, each no larger than 50 microns across, apparently because the grains load more deuterium without fracturing from the buildup of mechanical stress.[7] De Ninno concludes that variations in grain size and shape cause large differences in performance, and this factor alone may explain all of the variability in performance. This did not surprise experienced electrochemists. During ICCF7, the NEDO Japanese researchers described how they had made great efforts to fabricate large grain cathode metal. Robert Huggins heard the presentation and said to me, "That's a splendid effort but it is just the opposite of what they should be doing." Huggins prepared his first successful cold fusion cathodes in 1989 by pounding the metal with a hammer to make it more amorphous.[8]

At Bell Labs in 1948, Gordon Teal made an educated guess that a single crystal germanium would be needed for predictable, effective transistors. Teal thought he could develop a process to fabricate single crystals of far greater purity than any then in existence. William Shockley, the head of transistor research, was headstrong and did not appreciate how important this was. At first he paid no attention to Teal's work. Teal had to pursue the project at night with "bootlegged" equipment. He would unplug his apparatus every day, roll it into a closet, and work on his official assigned task instead, which is how many cold fusion experiments are performed.

In 1949 Teal gave a sample of his germanium crystals to a chemist in the newly-formed semiconductor research group. The chemist tested the electron and hole mobility of the crystal and found that performance was twenty to one hundred times better than that of the conventional, polycrystalline samples. "As word of this success percolated through the semiconductor group, Shockley finally began to sit up and take notice of Teal's work. By late 1949 he had to admit he had been wrong. . . . Soon Bell Labs would have an entire group devoted to growing single germanium crystals."[9] A few years later Bell Labs developed zone refining, which made materials 1000 times purer than any previous technique. This alone would have been sensational, even without transistors. It was one of many breakthroughs needed to make transistors practical. The transistor was not "one" innovation; it was the culmination of a series of related and directed innovations triggered by the 1948 breakthrough. You could not make a practical transistor without ultra-pure single crystal germanium (later, silicon), but no one thought to make ultra-pure single crystal germanium until the first crude, unreliable prototype transistor was demonstrated. No one investigated small grain palladium in detail until many years after 1989. Cold fusion will not succeed until many other related, directed innovations are undertaken to support it, which will cost huge amounts of money.

Lessons

The early history of transistors teaches many lessons about how science works and what to expect in the early stages of groundbreaking research.

Prototype inventions are often crude, unreliable, and makeshift. The first point contact transistor was held in place with a spring fashioned from a paper clip, which literally pushed a point down to keep it in contact with germanium. Kilby described the first integrated circuit: "It looked crude, and it was crude." Riordan and Hoddeson add, "These prototypes were extremely awkward realizations of the much more sophisticated ideas he penned into his notebook two months earlier. But the first prototype of an important technological idea is often crude—witness the first transistor."[10]

Some experiments are too crude. Shockley was a theoretician, not an experimentalist. One day in 1940, a scientist named Wooldridge found him fiddling around in the lab with a piece of oxidized copper, which "had apparently been cut out of some very old copper back porch screen with very dull scissors." Shockley was trying to position wires so they would barely touch the green oxide coating. He hoped to adjust the voltage applied to the mesh to control the current flow. In other words, he was trying to make a crude transistor. Wooldridge later wrote: "So here he had the three elements of a transistor, these two wires and the copper screen. Of course, he was *orders of magnitude* away from anything that would work!"[11] Most of the 1989 "replications" of cold fusion were equally laughable. Critical electrochemical parameters like loading and open circuit voltage were not measured; materials were not analyzed before or after the run. This is flailing in the dark, not science. You might be orders of magnitude away from anything that will work, or you might be on the verge of success. You have no way of knowing, and even if you do achieve success, you will be unable to replicate the effect.

Scientists must pay close attention to inexplicable phenomena which may look like instrument errors at first. They should not dismiss weird, marginal, unexpected, anomalous phenomena. In the 1920s, silicon crystal radio detectors developed a bad reputation. "Variability, bordering on what seemed the mystical, plagued the early history of crystal detectors and caused many of the vacuum tube experts of a later generation to regard the art of crystal rectification as being close to disreputable."[12] In 1938 a scientist named Becker at Bell Labs tried to measure the conductivity of silicon rods. When the probe was moved from one spot to another, conductivity varied wildly. One of the rods was "so erratic that no consistent values could be reported." The rod was put aside and forgotten for a year until Russell Ohl examined it carefully and discovered that it acted as a photovoltaic cell, converting light into electricity. This was the first time anyone had seen the photovoltaic effect in silicon. It was the real start of AT&T's research in semiconductors. Ohl later said that Becker's career suffered:[13]

> He had that active silicon in his department, in his hands, and he didn't find it . . . That is what you are up against in research. You've got to watch for things like that, for something unusual. If that happens, you have got to learn to recognize it.

Not eloquent perhaps, but it expresses an essential truth which many scientists pay lip service to, while in practice they ignore. Many scientists have ignored evidence for cold fusion. In a few cases they have actively tried to bury it.

You must be careful not to fool yourself. After the triumphant in-house demonstration of the first functional transistor in 1948, one of the observers cautioned the discoverers: "Look boys, there's one sure test of an amplifier, that you aren't kidding yourselves. An amplifier, if fed back on itself with a proper circuit, will oscillate. This shows that it is really producing power—more than you put into it."[14] The next day, Brattain performed the feedback test and confirmed that the device did oscillate. Many cold fusion scientists have failed to perform

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simple calorimetric tests which would reveal that their devices are "really producing power" and other simple tests such as autoradiographs, which confirm that the effect really is nuclear.

Scientists should cooperate. While manufacturing radar sets and other electronics during World War II, AT&T learned the value of close cooperation between theoreticians, experimentalists, and production line workers. The economic boom and postwar office space crunch helped to prolong this cooperation. Bell Labs rushed to hire many new scientists while it completed a new laboratory. When Bardeen joined Bell Labs in 1945 "office space was extremely scarce . . . So employees were being asked to double up . . . Bardeen didn't mind; he liked the company of experimentalists. Here was an opportunity to glance over their shoulders and talk about the data as they collected it."[15] This spirit of cooperation was essential to the rapid development of transistors.

Success Was an Accident

Success in research is often the unlikely result of a series of accidents. Consider some of history's might-have-beens. Gordon Teal worked at night on his "bootleg" crystal-growing experiments and during the day on his regular assignment. His wife grew upset at this overwork, and asked him to cut back. She might have prevailed, or he might have grown discouraged and burned out on his own. Or he might have missed the opportunity to show the chemist his single crystal sample. Shockley might have remained characteristically obstinate, continuing to ignore Teal's research. This one oversight by Shockley might have held back the development of transistors for years. Thousands of technical decisions and choices must be made in the course of developing a commercial product, and each might be a wrong turn or a dead end. That is why research must be done by many different independent laboratories, at different corporations and universities. One person or one funding agency committee cannot be placed in charge. One person, no matter how brilliant, may guess wrongly and lead the whole project into a dead-end. Competing ideas must be tested, even ideas the experts consider crazy.

In their Epilogue, Riordan and Hoddeson describe the mix of personalities and institutions needed to bring about the transistor:[16]

> None of these men [Shockley, Bardeen and Brattain] could have invented the transistor alone. But their lives intersected at a unique American institution during a peculiar moment in history to make it possible, even likely. Nothing on the scientific landscape at the time compared with Bell Labs. It combined intellectual power equal to that of the nation's best science departments with technical resources and manpower that none of them could come close to matching. When these tremendous resources became focused on developing practical products based on wartime advances in semiconductor technology, something big had to happen . . .
>
> Each man's shortcomings were compensated by the others in this multidisciplinary environment. With his single-minded focus on "trying simplest cases first," Shockley would never have conceived the unwieldy point-contact gadget that opened the door to the transistor . . .
>
> . . . Almost as important as the transistor's invention are the techniques of crystal growing and zone refining, which allow one to fabricate large single crystals of ultrapure silicon and germanium. Without these crystals, the industry would not exist.

This is contradictory. The mix of personalities was unlikely, the postwar boom was a "unique moment in history" which we hope will never be repeated (if it takes a war to trigger such a moment), yet "something big had to happen." The invention was unlikely yet inevitable. Was the transistor truly inevitable? Where would we be without it? Is any innovation inevitable and unstoppable? I will examine these issues in Part 2.

References

1. M. Riordan, L. Hoddeson, *Crystal Fire: The Birth of the Information Age*, (Norton, 1997).
2. Riordan and Hoddeson, *ibid*., p. 130
3. Private communication, 1999.
4. L. Hoddeson, E, Braun, J. Teichmann, and S. Weart, *Out of the Crystal Maze*, (Oxford Univ. Press, 1992), p.121.
5. S. Lohr, "Suiting Up for America's High-Tech Future," *New York Times*, December 3, 1995.
6. Riordan and Hoddeson, *ibid*., p. 219.
7. A. De Ninno, "Material Science Studies Aimed at Improving the Reproducibility of the Heat Excess Experiments," *Proc. ICCF7*, p. 103.
8. M. Schreiber *et al.*, "Recent Measurement of Excess Energy Production in Electrochemical Cells Containing Heavy Water and Palladium," Proc. ICCF1, Table 1, 2 and 3, p. 54.
9. Riordan and Hoddeson, *ibid*., p.179.
10. Riordan and Hoddeson, *ibid*., p. 259.
11. Riordan and Hoddeson, *ibid*., p. 86.
12. Riordan and Hoddeson, *ibid*., quoting F. Seitz of AT&T, p. 92.
13. Riordan and Hoddeson, *ibid*., quote from Ohl, p. 96.
14. Riordan and Hoddeson, *ibid*., p. 140. Note, however, that an amplifier does not literally produce power. It transfers energy from the power supplies to the output, increasing or decreasing power depending on the control current. All energy originates in the electric power supplies. With cold fusion the energy originates in the cell. Cold fusion cells sometimes resemble amplifiers. When the cathode current density increases, deuterium loading usually increases, and after a while the cold fusion power may increase proportionally, assuming other control parameters remain the same.
15. Riordan and Hoddeson, *ibid*., p. 120
16. Riordan and Hoddeson, *ibid*., p. 280

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the bigots of the APS have caused the needless deaths and disabilities of those who would have benefitted from the earlier development of cold fusion technology. They have delayed cold fusion technology by many years, while pollution, cold, and ill health from inadequate energy and dirty energy sources have taken an enormous toll.

Scientific knowledge and the opinions of experts can have a direct impact on life or death. In the 1840s, Semmelweis and a few other doctors discovered the benefits of antisepsis. They found that by carefully washing their hands and wearing clean clothes, they could reduce mortality (of women in childbirth) from 18% to 1%. Instead of embracing this discovery, his superiors reacted with hostility, and eventually drove Semmelweis into exile. Most mainstream medical people ignored the discovery, even though news of it spread far and wide. The news reached Boston a few years later, and the Hungarian government ordered all hospitals to use his techniques, but most doctors inadvertently went on killing patients for forty more years. Posterity blames them, and it will blame the APS and other mainstream scientists who have blocked research on—and even discussion of—cold fusion.

Nobel laureate Julian Schwinger resigned from the APS to protest its policy against cold fusion. He said, "The pressure for conformity will be the death of science." At the APS pseudoscientist circus in Atlanta, Schwinger was mocked for having been "senile" or "insane" for having worked on cold fusion theories. Read our account of the APS farce and weep. We were not dreaming this. We wish that it *had* been a dream.

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Fuel Cell Conference Report

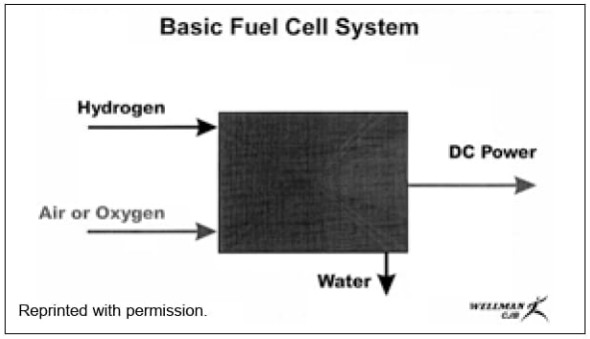
Institute of International Research Conference on Fuel Cell Vehicles,

Held on February 22, 1999

by Soo Seddon

Some of the motor vehicle and fossil fuel industry's finest gathered in the understated opulence of the Marble Arch Marriott Hotel, London to present their "practical strategies for overcoming the fuel distribution and marketing challenges to compete effectively in the changing automotive market of the twenty-first century."

The marketing manager of Ballard Automotive (Europe), Andre Martin, opened the conference with an overview of progress in the technology to date.



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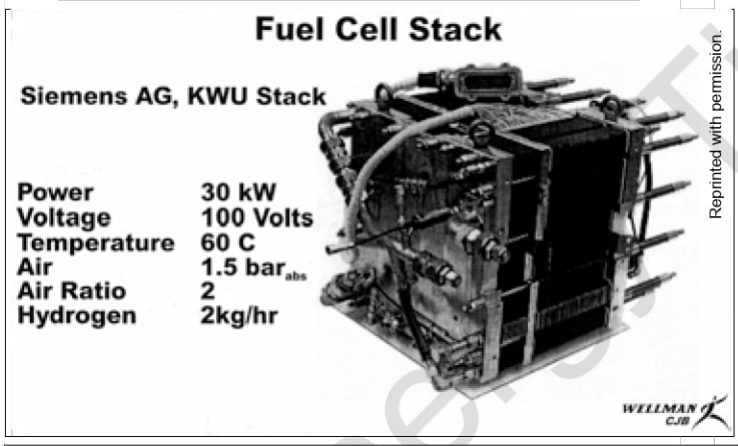

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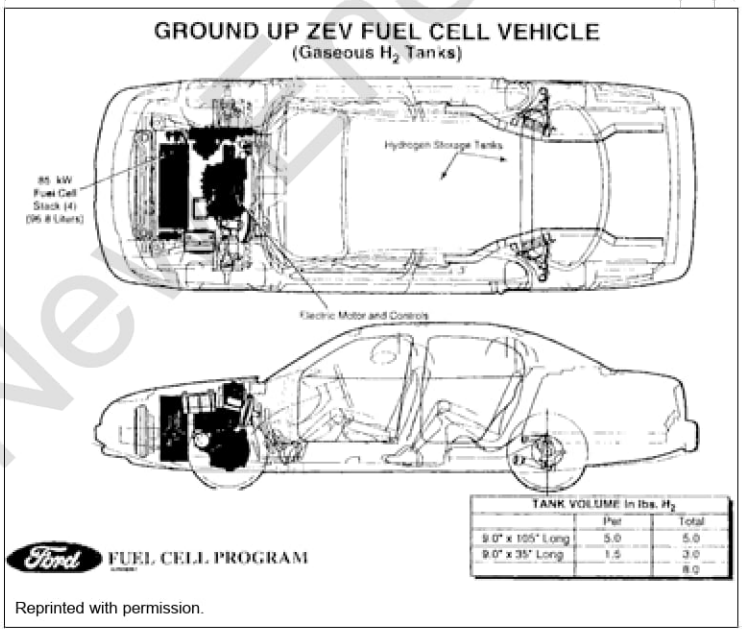

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Now no longer considered a somewhat exotic area of research, he stated that all major vehicle manufacturers worldwide were working on fuel cell applications and had allocated substantial resources in preparation for eventual mass production. His own company had formed a "strategic alliance" with Daimler Chrysler and Ford with the objective of going commercial by 2004.

The cell design favored by this trio utilizes Polymer Electrolyte Membrane technology (PEM). Each cell has a polymer membrane with an electrode layer sandwiched between two catalysts. Flow fields facilitate distribution and cooling, at the same time building the mechanical structure of the stack. Protons from the split H_2 diffuse from the anode through the membrane and electron flow to the cathode is via an external loop.

Measurements on the standard PEM so far indicate a voltage delivery of 0.6-0.7 with a power density of $1A/cm^2$, although it was allegedly possible to provide almost any voltage/current combination by reconfiguring the cell. Their state-of-the-art PEM can provide in excess of one kilowatt per litre of stack volume, rendering it appropriate for automotive applications.

Despite requiring additional chemical processes to produce onboard hydrogen, their favored fuel was methanol, mainly due to ease of handling and the fact that the pre-existing infrastructure could be used, with some adaptation.

Alastair Livesey, a senior scientist from Shell Hydrogen, began his presentation by assuring the assembly that his company didn't view emerging fuel cell technology as a threat to its livelihood, but rather as an "opportunity."

He outlined the technical hurdles which had to be overcome before an alternative fuel could be made viable, with relation to the specific chemical properties of hydrogen and methanol.

Methanol is highly hygroscopic (100% miscible with water); this was viewed as one of the major point of delivery problems necessitating the design of a completely dry dispensing system. However, its toxicity was Shell's overriding concern; a 25-100 ml ingestion has proven fatal in all known cases. Presumably, the antidote to methanol poisoning—alcohol—may yet appear on gas station forecourts quite legitimately labeled "For Medicinal Purposes." Additionally, methanol biodegrades very speedily and has only half the energy density of gasoline.

Hydrogen fueling, however, was a much trickier proposition. Leaving aside Hindenburg Syndrome and H-bomb associations, its tiny molecular size made leakage a major storage problem. Then there was the flammability issue; hydrogen burns seven times faster than natural gas or gasoline although is twenty-two times less explosive than a similar volume of gasoline vapor. There was some danger that no one would see a hydrogen fire, with its virtually invisible flame; presumably chemical additives could be used to alleviate that particular problem but there would, of course, remain the risk of liquid hydrogen cold burns.

Another hydrocarbon county heard from. . . Andrew Armstrong, Senior Fuel Advisor for BP Amoco, gave his company's timeline for introduction of the new technology, with an emphasis on how his organization was very keen to comply with new emissions legislation in the U.S. and the European Union (EU). They are currently collaborating with General Motors and believe that hydrogen-powered fuel cells are more cost effective and efficient and that hydrogen will be

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Millennium Media Watch U.K.

by Soo Seddon

Pre-millennial tension hangs heavy in the damp winter air and British newspapers are already becoming saturated with the futuristic speculations of eminent social, political, and scientific commentators.

There are few more eminent than the redoubtable Sir Arthur C. Clarke, who was persuaded by the *Sunday Telegraph* (February 21, 1999) to give his personal technological forecast for the next hundred years.

Predicting the future or extrapolating it, as he prefers to say, is one of Arthur Clarke's particular talents, and one he has exercised with uncanny accuracy for many years.

In an article for *Vogue* magazine in 1966 he accurately speculated that multi-channel satellite TV, facsimile machines, mobile phones, and computer access to global information systems would be commonplace well before the year 2001.

So what does he "extrapolate" for beyond 2001? Of particular interest is his prediction for the year 2002 when, he states: "The first commercial device producing clean, safe power by low-temperature nuclear reactions goes on the market. . ." He envisages that Fleischmann and Pons will, at last, be vindicated and duly receive their Nobel for Physics.

Eight years later, he suggests, a quantum generator will be developed, a device capable of tapping the vacuum and producing limitless electricity. An inevitable by-product of this technology will be the ability to control matter on the atomic level, resulting in nuclear transmutations on a commercial scale.

He anticipates that the energy revolution will signal the end of the cash-based economy—the new international unit of exchange will be the megawatt hour.

He does offer a warning, however, that the over-use of Earth's natural resources (in particular the extraction of atmospheric CO_2 to facilitate food synthesis from carbon) could well result in the need, towards the end of the first century of the new millennium, to resume the burning of fossil fuels, replenishing the air, and staving off another Ice Age by deliberately promoting global warming.

Mankind, he predicts, will make serious headway in his exploration of the solar system, spurred on by the discovery of the Galileo probe in 2011 that there is life on Jupiter's moon, Europa. Ten years later, the first humans may land on the martian surface where, in typically tantalizing Clarke fashion, he merely states that they will have "some unpleasant surprises."

He suggests that society will, at last, slowly begin to learn from the mistakes of the twentieth century, but that there will be a major disaster before it is unilaterally decided to destroy all nuclear arsenals and also for us to take measures to protect Earth from meteor impacts.

Life truly begins to imitate art when, he states, Disney opens its "Triassic Zoo" with dinosaurs cloned not from prehistoric remains encased in amber, but from computer-generated DNA.

The "Braincap," a fascinating device featured in his novel "3001" could, he says, become reality in 2025—a consequence of enormous advancements in neurological research.

"Optimism about the future is always desirable," he writes, "It may help to create a self-fulfilling prophecy." Hopefully, his own optimism that he will be one of the first guests in the orbiting Hilton Hotel on his 100th birthday will clearly demonstrate the validity of that statement. ❑❑❑

Fred Clarke – A Profile

Sir Arthur doesn't quite hold the monopoly on literary talent in the Clarke family. His late mother, Nora, and younger brother, Fred, have both had their names adorn book covers.

Nora's *Four Feet on the Ground* is a charming collection of tales of Somerset country life in the 1930s. She was over eighty years old and highly delighted when her stories were published, first in a local newspaper and then in book form.

Fred's *Four Heads in the Air* is a sort of sequel, in which he describes with fondness and great humor, his early life at Ballifants, the family farm near Taunton, with his two brothers and sister. Fred, the second son of Charles and Nora Clarke, was born in 1921 in Minehead. He attended Huish Grammar School where older brother, Arthur, was already profiting from his writing skills by earning sweets for his sterling efforts in the English class and for the school magazine.

Fred's first job was with the Post Office. In the early years of the war, when he was age 19, he witnessed a train load of battered and weary Dunkirk veterans pull into Taunton Station. The next day he volunteered for military service and was more apprehensive about explaining his actions to the Head Postmaster than he was of what might be awaiting him overseas.

He served as an Engineer in West Africa, India, and Burma. His wartime adventures are recorded in his hugely entertaining book *The Road to Spiderpore* which he wrote, he says, to assure one of his inquiring grandchildren that he didn't really participate in the cavalier/roundhead conflict (English Civil War).

Soon after the War, he took up residence in Wood Green, London, where he worked as a heating engineer. His technical treatise, *An Introduction to Small Pipe Central Heating*, became a state-of-the-art textbook for fellow engineers. While in London he became involved with many worthwhile and charitable causes. A Rotarian since 1969, he has organized countless fund-raising events. One particularly close to his heart is the restoration of the impressive concert organ in Alexandra Palace, which suffered greatly from wartime damage and subsequent neglect.

Fred's fondness for a challenge was put to the test again when twenty years ago he moved to his present home, a rambling 200 year old mansion just outside Taunton.

Fred Clarke and his great-nephews outside Ballifants.

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The place, when he bought it, was completely derelict with rotted floors and joists. He describes it as a dead-ringer for Miss Haversham's house in *Great Expectations*, giant cobwebs from floor to ceiling. He first made the adjacent cottage fit for habitation by his mother, who had returned to the U.K. after living for some years with Arthur in Sri Lanka. For the next fifteen years he worked on reinstating the main house, mostly by his own efforts, one room at a time. . .all thirty rooms of it! A suite of lovingly restored rooms on the ground floor form the Head Office of Rocket Publishing, while Fred and wife, Babbs, share the rest of the house with an enigmatic Abyssinian cat who, Babbs says, sort of wandered in one day and adopted them.

Fred remains philosophical on the subject of house restoration: "It's been very interesting," he said, "But I wouldn't fancy starting it all over again now at my age." ❑❑❑

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the ultimate fuel choice of the future.

BP/GM had a less optimistic 2005 as the date by which the first methanol fuel cell vehicles would be commercially available but, revealing their penchant for staying with fossil fuels and not swerving too far from traditional motor engineering (I thought), they projected a gasoline/diesel version on the market by 2018, followed two years later by a practical IC exhaust heat recovery engine. It would take until 2040, they believed, for the hydrogen storage problem to be effectively resolved.

John Bereisa, Director of Technology Assessment and Acquisition at General Motors' impressively-titled Global Alternative Propulsion Center, presented the results of a company survey on the current pitfalls and hoped-for future of personal transportation.

Global warming, they had discovered, was simply not an issue with the general public who listed their main pet peeves, in order, as traffic congestion, parking difficulties, and poor standards of driving generally. Only later came some small concern for local pollution in towns and cities.

Most people surveyed expressed concerns that fuel cell vehicles would be less powerful than their gasoline equivalents, the consensus being that if it "didn't burn rubber, it wasn't a car." I should (perhaps unnecessarily) add that the contributors to this particular statistic were all male. . . GM could find no women who had even heard of fuel cells! Few were enthusiastic about the emerging technology, and exhibited all the classic signs of "techno-fatigue" in that there appeared to be a lot of hype about such things but seldom much actual progress. More surprisingly, very few people (not even the females!) expressed the slightest concern about the safety of alternative fuels like hydrogen. The conference generally had an air of unhurried, half-hearted enthusiasm. The oil companies were sitting happily on their forty year reserves and dabbling with the alternatives in a somewhat laid-back fashion. One abiding theme seemed to be the desire for inter-company collaboration and the free exchange of non-commercial information. A new Gold Rush this clearly isn't! The man from Shell, when asked for his views on cold fusion-powered vehicles, merely shrugged and started waffling about other biomass alternatives. . .Fuel technologists are most definitely very reluctant to lift their heads above ground. However, it's rather nice that they are spending megabucks on adapting existing infrastructures. . .much less work and hassle for the cold fusion cell vehicle engineers of the future, I reckon.

❑❑❑

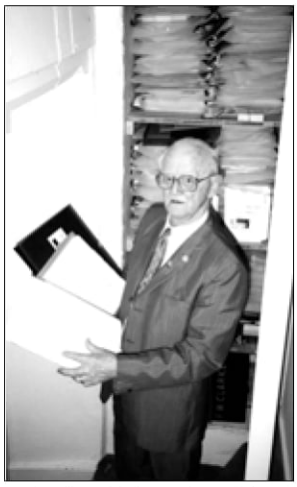
2001: Another Clarke Odyssey

by Soo Seddon

Fred Clarke's home near Taunton, Somerset is a small scale Arthur C. Clarke museum. His office walls are lined, floor to ceiling, with bookshelves crammed with the collected works of his famous elder brother. There are, he estimates, around 2,000 volumes in just about every language.

Literary accolades dominate every available flat surface. All writers of science fiction aspire to win a Hugo or Nebula; here there are three. . .of each!

Fred Clarke with artists image of ACC Centre. *Photos by Soo Seddon*



Fred in front of the safe containing most of Arthur's original manuscripts.

Arthur's medals.

Showcases contain models from the film set of "2001" and the walls are hung with portraits and original artwork from book covers which were presented to Sir Arthur.

Fred has been acting caretaker of this amazing collection for over thirty years and is very keen to share his historic archive with the world. To this end, he is actively engaged in raising funds to build an Arthur C. Clarke Space and Communications Center in Arthur's birthplace, the nearby seaside town of Minehead.

He has already obtained a prime site in the Town Centre adjacent to the West Somerset Railway and has impressive, costed plans approved by the local authorities.

The proposed three-story structure, as well as housing Arthur's manuscripts, awards, and memorabilia, will contain interactive

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arrays, lecture halls, theatres, laboratories, and a planetarium. In addition to displaying exhibits of historical significance, it is planned that the Center will evaluate emerging new technologies, along similar lines to that of the ACC Centre in Sri Lanka.

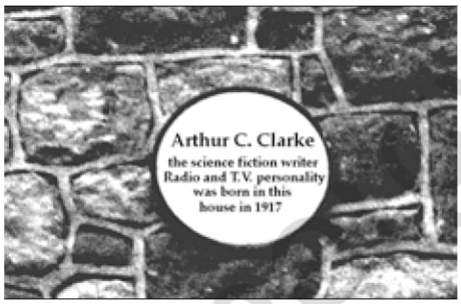
There is lots of local enthusiasm for the project and Fred has never considered locating the Center anywhere other than Minehead; despite pleas from many prestigious academic organizations throughout the world, he remains fiercely loyal to his, and Arthur's, home town.

It is hoped the Centre will be fully operational in two years time. Twenty years ago, when he first dreamed up the project, he actually "booked" Arthur to personally perform the opening ceremony.

A highly appropriate task in 2001 for the science fiction author of the millennium. ❑❑❑

Photos by Soo Seddon

Silver rupees embedded in coral, brought from the sea bed by an expedition of which Arthur was a member.



I have made many thousands of friends during my lifetime through common interests in Space, Underwater, Literature and Science. These are fascinating subjects, whether studied as a hobby, or taken up as a career, and lead to lasting friendships and wonderful memories.

If my work and ideas can be continued in Minehead in the coming Millennium, I am certain it will make more friends for my hometown and have far more impact than I could ever achieve in one short lifetime.

SIR ARTHUR C. CLARKE

FOR MORE INFORMATION:

Arthur C. Clarke Foundation of Great Britain
Dene Court, Bishops Lydeard, Taunton
Somerset TA4 3LT, England
Tel: 01823 432001 Fax: 01823 432083
Website: www.acclarke.co.uk

THE "CLARKIVE"

by Soo Seddon

Arthur Clarke's U.K. Assistant, Chris Howse, swung back the doors to a huge cupboard safe and quipped, "As you can see, we don't want Arthur to write any more books." It would have been a major challenge to find space for even a small leaflet. Every shelf was stacked to capacity with sealed plastic binders, each containing a unique and precious bundle—an original Clarke manuscript. "There are a few that we don't have," he said, "Several have been donated to museums and libraries around the world. But we have a nice little collection here."

Chris Howse posing with magazine containing A.C. Clarke's first published story.

With that slight understatement, he opened up one or two to show me. It was awe inspiring. Here, in original form (several of the early manuscripts were neatly hand-written), were the texts of books I first read with amazement and wonder as a space-struck teenager. "There was no sense of motion, but he was falling towards those impossible stars, shining out there in the dark heart of a moon," I read from the original manuscript of *2001* and reckoned I knew roughly how Dave Bowman must have felt. Chris has been the curator of the Clarke archive, or "Clarkive" as Sir Arthur dubbed it, for the last thirteen years. His office houses the main publications library: row upon row of boxes containing seven decades worth of technical essays, articles and commentaries. There are banks of cassettes—the video library comprising the movie collection, audio books, and recordings of TV and radio programs featuring Arthur and his work. He also maintains a gigantic library of press-cuttings which is increasing in volume at an alarming rate as the year 2001 draws nearer. Arthur C. Clarke and the new millennium appear to have become synonymous. Chris has a keen interest in space art. One of his favorite paintings, displayed in the main office, is of a plaza in a futuristic city featuring the literary knight himself in amongst the crowd, and sporting a very trendy Flash Gordon-style outfit . . . nice legs, Arthur!

The book covers are one of his particular joys. He likes to compare the illustrations on different editions and is rather skilled at determining in which country each was published, based on the artwork alone. One of the more exotic is a French language edition of *The Wind from the Sun*, its cover adorned by a nubile, naked female Icarus with expansive iridescent wings. Tucked inside is a letter of bemused apology to Arthur from its translator who clearly couldn't quite grasp the relevance of the image either.

Chris met his boss for the first time in the 1980's, during one of his then frequent visits to the U.K., and seven years ago enjoyed what he jokingly called a "busman's honeymoon" in Sri Lanka, Arthur's wedding gift to him. Nowadays, they stay in frequent contact via phone and e-mail, utilizing the very technology first proposed by Sir Arthur way back in 1945. ❑❑❑

New Energy Times Archive

Unbridled Enthusiasm, Serendipity, and Scientific Discovery: A Personal Reflection on the Scientific Life

Michael C. Nicolaou
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In the June 1996 issue of *Thermoelectric News*[1] a curious statement was made, "Part of the challenge for the future will be to balance unbridled enthusiasm and optimism." I couldn't disagree more. Let me advise anyone in any kind of scientific research, especially the younger generation of scientists. Do not listen to the above statement—stay away from it as far as you can. It is bad for your serendipity; nay, it is disastrous!

And what is serendipity? Serendipity is the ability to make discoveries, inventions or do any kind of creative work in a very natural way. It is your ability to discover new concepts, new models, new theories, new laws, in any area of human knowledge. It also stimulates your creativity in the neighboring and very important field of applied science—technology. The terms serendipity and creativity are, in fact, synonymous.

Through unbridled enthusiasm—a strong and uncontrollable feeling of hope—serendipity is created. Natural enthusiasm, or hope, is the fundamental driving force behind any kind of intellectual work, no matter how simple or how sophisticated. Even though you are usually unaware of it, it is that spiritual juice or fountain, deep inside of you, that enables you to forge ahead comfortably through all the hassles, strains, and ups and downs. Without that hopeful feeling, or enthusiasm, you are not likely to accomplish much, if anything at all, in the kinds of activity I am referring to.

When your natural enthusiasm begins to grow beyond control, and becomes overwhelming, then you come under the influence of unbridled enthusiasm—the giant of hope. It is only at this point in your life that your creativity is at its peak. Blessed and fortunate are they who are fully cognizant of this, so that they may make the most of this enormous flood tide or multiplication of their spiritual resources. It is very similar to the phenomenon of resonance in physics, although, in essence, it has nothing to do with it.

Unbridled enthusiasm comes as a "charisma" or "magic touch," which is invisible. You cannot pinpoint it, but you are fully aware of it and feel its presence very strongly inside of you. While under its influence, you sense a substantial increase in intellectual powers; memory is also sharpened. You sense a certain aggressiveness building up between you and the people you are dealing with. You likewise become more critical of many things around you; you are in a strong fighting mood, as if you were a lonely soldier in a battlefield, waging an incessant and unrelenting war against that vast curtain of ignorance that surrounds you. You are trying to penetrate or destroy that veil, because you know that behind it lies the truth and the new knowledge you seek.

That could very well prove to be the greatest accomplishment and reward of your lifetime. You are on a continuous attack on all fronts, and the battle is unstoppable. You acquire an enormous courage of thought and action, and are not afraid to grasp and express new concepts and ideas. You are not satisfied with anything. In your inner thoughts, you criticize all pre-established knowledge, as well as the attitude and behavior of a lot of people around you. You become more sensitive than usual, and begin to understand certain things much better than ever before. Some of the people around you commend you as an extraordinary person, while others resent you. You begin to feel isolated from those around you. You are waging a gigantic battle, entirely alone by yourself, against an invisible enemy, who is nothing but our own ignorance of the natural world. You have no allies. You feel extremely bold and courageous, beyond your wildest expectations. You must watch out and guard yourself, nevertheless, against a sudden attack of despair while in this stage. This is a very vulnerable point confronting all those who choose to undergo that kind of experience. Only your own endurance, perseverance, and will power can save you from such a setback. This is the most difficult path of all.

These are the main manifestations of unbridled enthusiasm, or serendipity, at its peak. Only when you are under such an influence can you make the greatest contribution, discovery, or invention of your life.

Sir Isaac Newton, in statements attributed directly to him, mentioned that he felt his intellectual powers were at their peak when he was 23. About that time he was on a lucky streak, which lasted eighteen months, during which time he made the most important scientific discoveries that established his fame. Without a doubt, that lucky streak he felt he was on was nothing other than unbridled enthusiasm.

Without being immodest, I passed through the same kind of experience when I was doing my graduate work at Alexandria University. Unbridled enthusiasm was with me, for about four years, while pursuing my research work for my master's and doctoral dissertations. I felt that my intelligence had reached its highest level ever when I was 26. Unbridled enthusiasm suddenly left me about a year and a half before my doctoral dissertation was due to be completed. I felt that the path towards the Ph.D. degree had suddenly become very torturous, difficult, and overwhelming. I didn't have that same feeling earlier, while I was under the influence of unbridled enthusiasm. All the important and original contributions had been made while I was under the influence of unbridled enthusiasm. When that came to an end, I had to rely on absolute will power—utter determination— to bring my Ph.D. research work to its conclusion.

It is not an indisputable fact that great pioneers of science such as Isaac Newton and James Clerk Maxwell made their great discoveries because they had "IQs" of 190 or 180. Science historians would have you believe that, but that is pure baloney. The truth of the matter is that both Newton and Maxwell must have had very high IQs while they were under the influence of unbridled enthusiasm. The same applies to other pioneers of scientific and technological innovation. They did not keep making discoveries continuously during their lives, but rather during those relatively shorter periods, while they were under the influence of unbridled enthusiasm. They spent the rest of their lives perfecting and improving those discoveries, and putting them into final form. They also wrote articles, papers, and books, setting forth their accomplishments to their contemporaries, fellow scientists and students, and preserving them for those who would succeed them in the generations to come.

We may now pause to catch a glimpse of what is going on in modern university departments and academic circles, or even scientific conferences. A not infrequent question is, "How many papers have you published thus far?" You answer perhaps, "Thirty-five or fifty." They may reply, "I have already published eighty or a hundred papers, and I am still ten years younger than you." This is their way of intimidating and letting you know that you are an inferior creature. This kind of thinking is constantly used as a criterion of promotion in academic departments to decide which faculty member gets promoted and which one doesn't.

Let me cite another example, again from the field of physics, which serves to demonstrate the extreme importance of quality

New Energy Times Archive

in scientific research work and its eventual impact on scientific discovery. I cite the pioneering research work by French theoretical physicist Louis V. de Broglie on the wave-particle duality of nature. De Broglie's research constituted his thesis, submitted to the University of Paris in 1923 for the degree of doctor of science in physics. De Broglie's thesis was published in 1924 and he finally received the Dr.Sc. degree the same year.

However, that was not the end of it. Five years later, at the age of 37, His Royal Highness Prince Louis V. de Broglie (he was a descendant of French royalty) made the most important trip of his life. He left for Stockholm to receive the Nobel Prize in physics, from the hands of the King of Sweden. The awarding of the prize was based mainly on de Broglie's thesis submitted to the University of Paris five years earlier. His legendary career in physics seems to defy any and every scientist's wildest expectations. It is indeed more exciting than the fanciest fairy tale. It constitutes a unique example that had never happened before, and may never be repeated. The uniqueness of de Broglie's case is that both the doctor's degree and the Nobel Prize in physics were bestowed upon him for exactly the same piece of research work— his doctoral thesis that was concluded in 1923/1924.

His concept of the wave-particle duality of light most certainly was a great scientific discovery. It was by no means inferior to the other big discoveries of the earlier part of the century, such as Schröedinger's wave mechanics, Bohr's quantum model of the electronic orbit, Pauli's exclusion principle, Heisenberg's uncertainty principle, etc. Louis V. de Broglie must have been an idealist of the highest caliber. He had a very deep love and respect for science. These qualities must have triggered an enormous thirst for knowledge, which brought about an unbridled enthusiasm within him towards his scientific research. His discovery of the wave-particle duality of nature was certainly made while he was under the influence of that unbridled enthusiasm at its peak. This is exactly how all the major discoveries and inventions were made and will be made in the future.

The foregoing analysis demonstrates in very clear terms the prevailing absolute lack of interest in maintaining the highest standards of quality in all areas of intellectual work, particularly scientific research. This unfortunately is a general syndrome, which very few people pay attention to. The most detrimental effect of that syndrome is the almost total annihilation of the element of innovation in scientific research in general. This is particularly the case of the graduate research work conducted in the science and engineering departments, in the various colleges, universities, and institutes of technology nationwide. Such research work is normally supervised by faculty members and carried out by their graduate students. It usually leads to the doctor of science or doctor of philosophy degree. Everything is programmed for the student in advance. There is a certain minimum number of courses, mainly graduate or advanced, that are to be taken. The course load by itself is usually substantial, so that the thesis work, which is the only really creative part of the student's entire graduate program, consumes no more than 50% of the time normally allowed for the execution of the program. Creativity or originality in the research work required for the doctoral dissertation tends to be absent, or stifled, due to the overwhelming pressure placed on the student by the graduate courses, in most of which he must maintain a grade of no less than A. Further pressure is exerted upon the student by the qualifying examinations, which are an indispensable requirement in all top-notch universities. All these pressures are overwhelming. The situation is actually much worse, when we realize that everything during execution of the dissertation research is rushed, so that the thesis may be completed according to the pre-established schedule, before the funds provided by the relevant research grant or contract are depleted. Under such adverse circumstances, it is very unlikely that any kind of research work carried out by the student can be very creative. Originality, or creativity, may come later on in the graduate student's life, after he or she has earned the doctorate. Such would be the case if, despite all the foregoing pressures, he were still able to develop or maintain any kind of enthusiasm for further scientific work, whether unbridled or not. This seems to me to be rather unlikely for most individuals. That is how creativity, or unbridled enthusiasm, is annihilated.

Speaking again of courage, and its great significance in conducting scientific research work of singular quality, it is certainly very much relevant to recall the statements made by Dr. Chen Ning Yang 35 years ago. Dr. Yang was then interviewed by the science correspondent of *Time* magazine at his office at the Institute for Advanced Study at Princeton University.[2] The object of the interview was Dr. Chen Ning Yang's and Dr. Tsung Dao Lee's recent winning of the Nobel prize for their major discovery that led to the downfall of one of the fundamental pillars of modern physics at that time: the conservation of parity. Dr. Yang's interview, I believe, was published in 1962, headed by a large half-page photograph of him, under the title : "Yang on Yang." *Time* magazine's report started: "At the age of 39 Chen Ning Yang can look back with satisfaction on a career that brought him the Nobel Prize in physics." Dr. Yang stated that as new discoveries come about, especially on the microscopic scale, the picture of nature becomes more and more complex. He also added : "Maybe some brilliant young scientists will make additional discoveries in the future that will help us understand nature still further. " At that point the interviewer intervened and asked him : "Some brilliant young scientists will have to make those new discoveries? Why not you, Dr. Yang, bringing them about? Why do you say that brilliant young scientists will be needed to bring forth these new developments? Why do they have to be young?" Dr. Yang responded by saying : "I do not think this will be possible for me now. When you are young, you tend to grasp new ideas very quickly and easily. As you grow older, that becomes more difficult, because you start marshalling a large number of counterarguments. I, now, sometimes ask myself the question: Have I lost my courage?" Chen Ning Yang and Tsung Dao Lee shared the Nobel Prize in physics in 1961, and *Time* magazine's interview of Dr. Yang took place several months later. I read that interview at the time of its publication; it created an unforgettable impression on me.

The only alternative to unbridled enthusiasm is "conventional wisdom." And conventional wisdom is what I strongly dislike. It is tantamount to a complete absence of creativity. It is conducive to nothing in the life of a scientist, or any intellectual person. Conventional wisdom is the deadliest and most vicious enemy of innovation and serendipity. I would be far happier having an abundance of unbridled enthusiasm within me, than having billions of dollars in my bank account. I would go one step further to say that unbridled enthusiasm comes from God, while conventional wisdom comes from the Devil. My bottom line is that unbridled enthusiasm is that invisible spiritual force, or spark, that has triggered and brought about all the major discoveries and inventions in science and technology, and all significant accomplishments in the arts and literature.

There are two different ways of doing scientific research, namely either experimentally or theoretically. There are thus two types of scientists: those who conduct the experiments and generate data and those who make theoretical interpretations of data. Some scientists, of course, get involved in both of these activities. The process started nearly five hundred years ago, about the time the New World was being discovered by Christopher Columbus.

That process, however, was still very slow. The real boost to scientific research, discovery, and invention was brought about through the invention of the steam engine by James Watt, on which he obtained the first patent in 1769. That was the "Big Bang" that created the so-called Industrial Revolution and

Nicolaou continued on page 46

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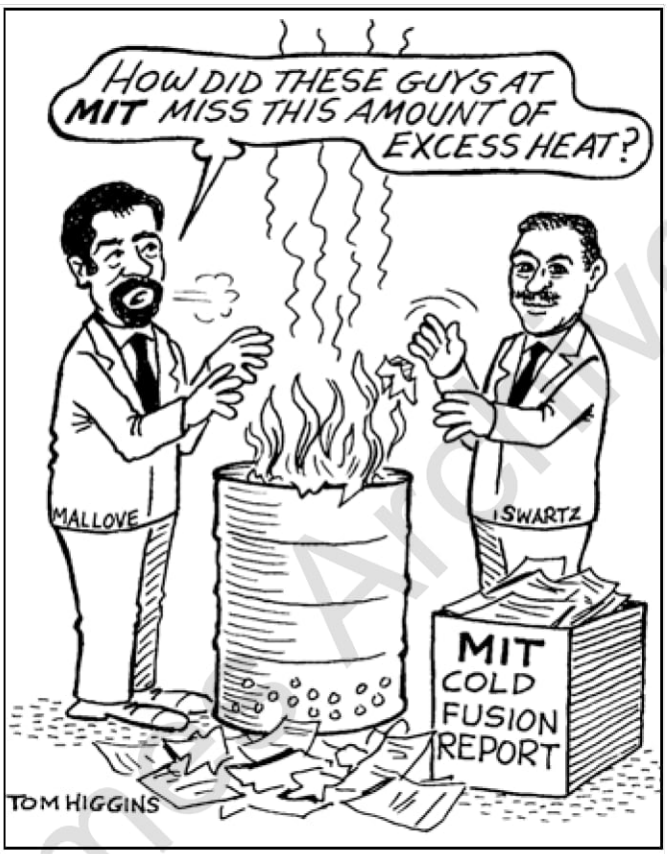
...and it reminds me of a line on scientific progress delivered by comedian Steve Martin in an old Saturday Night Live skit where he plays a medieval barber:

"Why, only a few hundred years ago, we used to think that diseases was caused by evil spirits. Now we know they are caused by a toad or a small dwarf attached to the spine."

Sent in by
Rick Monteverde
Honolulu, HI



"The Dead Scientists Poetry Society" BY SUSAN SEDDON

"Are Clouds Electric?"

by Benjamin Franklin

We chased a whirlwind long ago
My trusty steed and me
Three quarters of a mile we sped
And got back late for tea.

I do like storms and wind and rain
I'm 'specially fond of lightning
I was sure there had to be some way
To make static much less frightening.

Tooled up with kite and wellingtons
And various other things
(Some dudes got killed just trying this)
Mental note: Let go of the strings!

Kite soared aloft to sooty clouds
Like floating up to God
A zap, a whizz....electric fizz
I'd invented the lightning rod!

I've achieved some other stuff, of course
Helped blunt Brit-Yank war axes
Odometers, bifocals, stoves, apart
Nothing's certain but death and taxes.

Next issue:
"Apples give me headaches"
by Isaac Newton

"I'm beginning to understand eternity, but infinity is still beyond me."

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The difficulty lies, not in the new ideas, but escaping from the old ones.
—John Maynard Keynes

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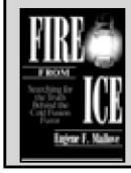

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See page 85 for a more detailed listing of conference speakers.

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See page 85 for a more complete listing.

For information about the topics of each speaker or to order, contact:
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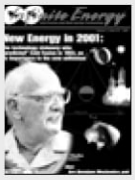

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Experimental Study on Cold Fusion in $Ni-H_2O-K_2CO_3$ Cells (Problems)

Carlos-Henry Castaño
Laboratorio de Electroquímica, Facultad Nacional de Minas, Universidad Nacional de Colombia
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INTRODUCTION

During the end of 1997 and the first half of 1998 the author conducted a series of experiments at the National University of Colombia.[1] We were trying to reproduce the excess energy, element transmutation, and generation of new microstructures in the cathode, during the electrolysis of a solution 0.57 M of potassium carbonate (K_2CO_3) in light water (H_2O) with cathodes of nickel of high interfacial area. After reviewing part of the existing research papers, it was found that none of the reviewed papers (see work Reference 1) defined exactly which factors lead to the generation of excess heat and phenomena associated known as "Cold Fusion." Moreover, it is common in these papers to find lots of undefined details, beginning with the purity of the reagent and even, as will be seen below, the conditions of the electrolysis are not specified correctly. Its lack of accurate details could well cause the failure in the attempts to observe the phenomenon of "Cold Fusion." Since this phenomenon has not yet been explained satisfactorily, it is very difficult to know which are the critical parameters and which are secondary. Therefore, it is important that researchers who report excess energy, as well as scientists trying to reproduce it, make a greater effort to define with accuracy the experimental conditions and the parameters that are suspected to be critical. Below is a short review of the factors that usually seem to be accepted as critical and to which we will need to pay more attention if the experiment is reported as successful. It should be emphasized that the information on these details must be supplied by those who may have observed the phenomenon of Cold Fusion in order to discriminate the necessary details from the unnecessary.

SUGGESTED FACTORS

Quality of the Water

It is known that upon distilling the water or even bi-distilling it (yet with $KMnO_4$), or after using ultrafiltering, pure water is not obtained,[1,2] however the papers do not establish an exact criterion on the quality of the water to prepare the solutions. In most cases the pretreatment is indicated that was submitted (bi-distilling, tri-distilling, ultrafiltering, etc.). In other cases, the conductivity of the water as an indicator of purity is presented,[3] or no criterion is given. However, this information is incomplete because it does not give detailed information on the ions that are present or any information on the presence and/or behavior of organic impurities. It would be convenient if the successful experimenters established a clear and exact criterion for the purity of the water; in this respect in Reference 2 several exact electrochemical criteria are established.

Purity of the Reagent (electrolyte)

Generally the salts to prepare solutions are not pure. These salts contain a great quantity of impurities in trace quantities. The presence of organic impurities is difficult to establish. The inorganic impurities are possible to establish by looking at the labels of the product. For example, the solution 0.57M of K_2CO_3 prepared with reagent "Merck für analysis" would have calcium impurities of 1.6 ppm. Though this concentration can seem quite small, in electrocatalysis this concentration is sufficient to modify definitely the nature and behavior of the metallic surface, and the behavior of the reaction carried out on the electrode.[4] Furthermore, though the potential is not sufficient to deposit several types of impurity ions, these can be deposited at subpotential. Many ions can be eliminated by pre-electrolysis and their presence reduced by a factor of 10 or more. However the idea exists that not all the impurities inhibit the excess energy, but some could promote it.[5] In spite of this interesting suggestion, the role played by these impurities in the phenomenon is not known. A way of overcoming this difficulty would be for the successful experimenters to report the exact experimental protocol of pre-electrolysis (potential, times, and electrodes) and their source of reagents.

Material of the Cell

This topic is complementary to the previous ones. If we are using very pure water and reagent, we cannot permit them to be contaminated by the materials of the cell. Opinions on this are divided: some consider the borosilicate glass sufficiently "clean," but others think that Teflon is the best material. Among the construction materials of the cell should be included, of course, the electrical connections to the anode and cathode, the recombiners (if there are any), the sensors, etc., and usually not considered but very important, are what products or methods were used to clean the materials of the electrochemical cell.

Cleanliness and Pretreatment of the Electrodes

This topic generally is mentioned with some detail, however there is not a unanimous criterion on how to clean the electrodes prior to electrolysis. The suggestions go from using organic compounds, or forbidding them, to making an anodic treatment, using H_2O_2 or even using the electrodes as they have been received from the provider. With respect to pretreatment, whether it be thermal, electrochemical, and magnetic, there is no detailed data about what to follow, what is the state of the surface of the nickel that is adequate for the reaction, or what is the state of the interior of the metal. It is not simple to achieve reproducibility of the experimental protocol if the same substrate for the reaction of hydrogen evolution (H.E.R) is not used. For example, in the case of the Nickel Fibrex 80/20™,[6] that it is a felt made with 80% fibers of 40 μm diameter obtained by extrusion of agglomerated nickel powder and 20% of nickel powder incorporated by sinterization to the fibers, the presence of impurities is common (*i.e.* 4% Fe, 1.5% Co). Since these impurities are not pretreated, they can affect the lattice parameter, density, hardness, volume and linear expansion, ionization potential, electronegativity, work function, d-character, boiling and melting points, and metal surface energy. The properties of the nickel can affect in greater or smaller degree the reaction of hydrogen evolution onto the cathode.[7] Furthermore, these impurities could be inhibitors of the phenomenon of excess of energy.[5] However, no paper evaluates the effect of the pretreatment on the state of the surface in spite of the dependence on the metallic surface and the H.E.R. The penetration of hydrogen into nickel can be affected by a factor of 70.[8,9] Furthermore, it can be supposed that different batches of Nickel Fibrex™ can have different composition of impurities, so it would be necessary to use a little different process in each case to equalize the samples. Besides, there are many classes of active nickel with respect to the hydrogen

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absorption. If we establish with greater care what is followed in the pretreatment, we could proceed more intelligently and in a general way, instead of just following a particular procedure.

Loading of the Electrodes and Routines of Electrolysis

If we combine the requirements of cell materials, solutions, and electrodes with adequate structure and clean surfaces, then we should be concerned with the problem of preparing the scenario for Cold Fusion. It is usually accepted that one of the key conditions to obtain excess energy is to obtain a high H/Ni atomic ratio in the cathode with the consequent hydride formation. However, to estimate this relationship in nickel is not so simple as in palladium, since the NiH_x is not uniform in the bulk of metal. Therefore, only knowing the quantity of hydrogen that has been absorbed in the nickel does not enable us to know the value of x in the hydride. By physical methods (high pressure) it is possible to obtain H/Ni atomic ratio of approximately 1 to 6.5 Kbar.[10] However, to obtain such high charges by electrochemical methods is more difficult. The nickel with hydrogen can be in several phases: the α-phase is a solution of atoms of H in the octahedral interstices of the nickel F.C.C. lattice, is presented for a relationship $H/Ni<0.03$, for a relationship $0.03<H/Ni<0.6$ the α-phase and the β-phase coexist, and for a relationship $H/Ni>0.6$ only the β-phase (Hydride) is present.[11,12] However the β-phase is a diffusional barrier that prevents more hydrogen to penetrate into the lattice of nickel; therefore, during the electrolytic evolution of hydrogen gas, only H/Ni of 0.7-0.8 [8,9,11,12,13,14] can be reached. The maximum loading value that can be reached of hydrogen in the lattice of a metal is influenced by the presence of cracks, irregularities, and accumulated tensions in the lattice.[15,16] Obviously this value is influenced by any pretreatment of the cathode. Furthermore, the β-phase modifies the lattice (expands it) and causes structural changes in the catalytic behavior of the nickel. However, it is not clear how the β-phase and the nickel behave under certain voltage routines. It seems that the sudden increases of overpotential, after an extended period of loading with low overpotentials, has some influence on the beginning of the phenomenon of excess energy. In spite of this, few papers that report excess heat indicate procedures to load the cathodes and the voltage or current routines used to trigger the excess heat.[17] Some reports only show the excess energy when the cell is operating in steady state.[18] However, the way to arrive there is crucial and sometimes sinuous. For example: to load the cathode with low current density and when the loading is high, increase then the current density in the cell.[17] It can be also be done by loading with low current density, then for a short period (seconds) increasing the current to very high values (1-2 A/cm^2) and then allowing the cell to achieve a steady state at intermediate currents. This process can be repeated many times.[19] To characterize in greater detail these routines of electrolysis, let's refer to the current density and the overpotential at which the cell must operate. The overpotential is a measure of the fermi level of the electrons in the metal. This level determines the given electrochemical reaction occurring or not occurring. Furthermore, this level also indirectly controls the kinetics, and it selects the reactions on the cathode.[20] On the other hand, the current density is the direct measure of the speed of the reaction of hydrogen evolution. It can control the loading of hydrogen in nickel that reaches the electrode. However, it is not possible to control both parameters (overpotential and current density) independently. They are interdependent electrically, if they contribute to electron transfer, to greater overpotential, greater current density (but not proportionally) and conversely. It has been suggested, for example,[21] that the graph of current density vs. excess energy is a concave-down function with several local maxima. It implies that the current densities should have specific values. Furthermore, to submit the nickel to very high overpotentials has the effect of modifying the surface of the nickel preventing it from absorbing hydrogen again at any overpotential.[8] Therefore, the conditions of electrolysis should be regulated carefully. Anyway, it is impossible to follow the procedures suggested in the papers that obtain positive results, because the current density is not clearly established. Current density is the current divided by the electrochemical real area, and to know this real area of complex surfaces (as in Nickel Fibrex) is not a trivial problem.[22] There are various ways of determining the area. The value obtained from the area of the electrode depends on the method used to measure it. The manufacturers of Nickel Fibrex™,[6] measure the area using B.E.T and report area values in the order of 1000 cm^2/g and more. This value is probably overestimated. Other authors use geometric analogies to approximate the value of the area[23] and also they have used voltametrics techniques[1] and other estimates.[24] In all the cases, the value found for the area differs in factors that go from 1.5 to 40 times. In spite of this, practically no paper reports the way to obtain this area. Therefore, the procedures of loading the electrodes and the routines for electrolysis remain undefined and to reproduce them exactly would be impossible.

CONCLUSION

As can be seen, there is a lack of characterization of the conditions that lead to excess heat. When reporting successful experiments, this characterization is indispensable, since to repeat the exact procedures in two different laboratories is practically impossible and to reproduce successfully the phenomenon is the first step in its comprehension. Decades could pass before the phenomenon known today as "Cold Fusion" could be satisfactorily explained. We should not let too much time pass before it could be widely reproduced and controlled, since this depends on whether it can be put into useful applications. For example, in 1879 Thomas Alva Edison developed an electrical bulb technologically satisfactorily, but the physical principles of its operation could be explained in detail only decades later when the quantified concepts were perfected. Moreover, this example, far from being an exception, is the rule: first we discover the phenomenon, we use it, and then we explain it.

This characterization will be done preferably using properties that adequately indicate the parameters of interest, not only to talk about potential, current, conductivity of the solution, and the sort of solution, but with more exact criteria such as voltametric curves, specific routines of pre-electrolysis, changes in the resistance of the cathode with the quantity of absorbed hydrogen, specific analysis of the surface, and the routines of pretreatment that not only indicate the conditions of the process but the clear criterion of when the desired state is reached to the satisfaction of the researcher. This information will be more useful and would permit researchers to try to reproduce the phenomenon. It will give ideas of the process and the opportunity to follow a previous particular experiment without knowing all the details, but with sufficient clarity to provide their own creativity in the resolution of the problems that are present. It will help to find an explanation of the phenomenon.

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References

1. C. H. Castaño, *Trabajo de Grado*, Universidad Nacional de Colombia. Medellín, Colombia.

2. B. E. Conway *et al.*, "Ultrapurification of Water for Electrochemical and Surface Chemical Work by Catalytic Pirodistillation," *Analytical Chemistry*. 45 (1973) 1331-1336.

3. R. D. Eagleton, "Experimental Details for Light Water Cold Fusion Research at Cal. Poly. - Pomona," *Cold Fusion Source Book*, International Symposium on Cold Fusion and Advanced Energy Sources. Belarusian State University, Minsk, Belarus. May 1994.

4. M. A. Riley and P. J. Moran, "The Influence of Iron Deposition on the Voltage-Time Behavior of Nickel Cathodes in Alkaline Water Electrolysis" *Journal of Electrochemical Society*, 133 (1986) 760-761.

5. R. T. Bush, "A Model for Impurity Promotion and Inhibition of the Excess Heat Effect of Cold Fusion," (Preprint supplied for the author). R. T. Bush. "Impurity Promotion & Inhibition" *Fusion Facts*, July 1994, 4-7.

6. National-Standard, Nonwoven Metal Products, 2401 North Home Street, Mishawaka, Indiana 46545.

7. M. M. Jaksic, "Advances in Electrocatalysis for Hydrogen Evolution in the Light of the Brewer-Engel Valence-Bond Theory," *International Journal of Hydrogen Energy* 12 (1987) 727-752.

8. M. Bernardini *et al.*, "Formation of Nickel Hydrides by Hydrogen Evolution in Alkaline Media," *Journal of Electroanalitical Chemistry*, 442 (1998) 125-135.

9. R. Juskenas *et al.*, "In-Situ X-Ray Diffraction Investigation of Nickel Hydride Formation During Cathodic Charging of Ni" *Electrochimica Acta*, 43 (1998) 1903-1911.

10. B. Baranowski, "Metal-Hydrogen Systems at High Hydrogen Pressures," in: *Hydrogen in Metals II*, G. Alefeld and J. Volkl, eds. (Springer, Berlin-Heidelberg-New York, 1978) 157-200.

11. H. E. G. Rommal and P. J. Moran, "The Role of Absorbed Hydrogen on the Voltage-Time Behavior of Nickel Cathodes in Hydrogen Evolution" *Journal of Electrochemical Society*, 135 (1988) 343-346.

12. B. Baranowski and Z. Szklarska-Smialowska, "A Galvanostatic and Potentiostatic Study of Nickel-Hydrogen System," *Electrochimica Acta*, 9 (1964) 1497-1507.

13. T. Boniszewski and G. C. Smith, "A Note on Nickel Hydride" *Phys. Chem. Solids*, 21 (1961) 115-118.

14. B. Baranowski, "The Dependence of the Cathodic Hydrogen Content in Thin Nickel Layers on the Current Density and Saturation Temperature," *Bull. Acad. Polon. Sci., Ser. Sci. Chim., Geol. et Geogr.*, 7 (1959) 897-905.

15. J. Bockris *et al.*, "The Permeation of Electrolytic Hydrogen through Platinum," *Journal of Electrochemical Society*, 113 (1966) 926-930.

16. Z. Szklarska-Smialowska and M. Smialowski, "The Kinetics of Hydrogen Desorption from Plastically Deformed Nickel" *Bull. Acad. Polon. Sci., Ser. Sci. Chim., Geol. et Geogr.*, 6 (1958) 187-190.

17. B. Klein, "Cold Fusion Testing, 2/25-26/95, at Clean Energy Technologies, Inc.," *Infinite Energy*, 1 (1995) 18-21.

18. R. D. Eagleton and R. T. Bush, "Experiments Supporting the Transmission Resonance Model for Cold Fusion in Light Water: I. Correlation of Isotopic and Elemental Evidence with Excess Heat," *Proc. Third International Conference of Cold Fusion*, October 21-25, 1992, Nagoya, Japan. p. 405.

19. R. D. Eagleton, California State Polytechnic University. Private communication.

20. J. O'M. Bockris, "Overpotential," *Journal of Chemical Education*, 48 (1971) 352-358.

21. R. T. Bush, "The Transmission Resonance Model Fits Data on Excess Heat, Predicts Optimal Trigger Points, and Suggest Nuclear Reaction Scenarios," *Fusion Technology*, 19 (1991) 313-356.

22. S. Langlois and F. Coeuret, "Flow-Through and Flow-by Porous Electrodes of Nickel Foam I. Material Characterization," *Journal of Electrochemical Society*, 19 (1989) 43-50.

23. R. D. Eagleton, California State Polytechnic University. Private communication.

24. Scott Little, EarthTech International, Inc. Suite 300, 4030 Braker Lane West, Austin, TX 78759. Private communication.

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brought us into the modern scientific and technological era. The generation of new scientific knowledge has become more and more pronounced ever since.

Unbridled enthusiasm is not for everyone. It is only for a select few. This may seem to be immodesty, but it is not. I cannot tell any person how to acquire unbridled enthusiasm. Everyone has to find out or discover that for themselves. There are no clear-cut recipes, but certainly there are important clues that I can give you. First, you must be an idealist by nature. You must be adamantly faithful to your own ideals and principles, and make no compromises concerning them. You must have such sensitivity within yourself, to be able to distinguish right from the wrong, good from bad, and strictly adhere to that in your personal life. Many people would dismiss this kind of advice as too naive, backward, simplistic, or merely stupid. They are absolutely wrong.

You must have a continuous and unrelenting thirst for knowledge, not only during the period of work to get your doctoral degree, but also every day of your life thereafter. You must have a deep respect and affection for science in general, and for special areas in particular. You must love scientific books, journals, and articles and read everything relevant that you come across. You must always be generous with your money in acquiring new books, journals, magazines, and all kinds of publications, if you feel they are significant to your work. You must continue doing research and investigating new concepts all your life. There should be no such thing as a deadwood person or scientist.

Do not be thwarted or worried by periods in your life, no matter how long, when you are largely unproductive scientifically. This happens to practically everybody. It can be due to pressure from excessive teaching loads, thesis supervision, heavy administrative duties, or all of these. Use these periods to meditate, review, and reassess in which direction you wish to go. You may have to change your focus, or your line of scientific research, completely. That could be a blessing in disguise. I believe, for example, that the main reason unbridled enthusiasm is with me once more is due to how I conducted myself in past years. I have never made any compromise on any of the issues or ideals that I set forth earlier. I put these above everything else in my life, regardless of the consequences. I never wavered on this. However, I paid a very dear price because of that. I had to relinquish a number of important jobs I held in the past. This has made my present situation very rough and uncomfortable professionally, financially, and socially. But I have no regret whatsoever. Regardless of the discomfort that I now feel, I have an immense satisfaction and peace of mind, which I believe very few people have nowadays. And that is how and why unbridled enthusiasm is with me in full force once again in my life. I have been under its influence for about three years now, since early 1995. It has made me, once more, very productive scientifically. I am going to see to it, therefore, that unbridled enthusiasm never leaves me.

I hope to win the "gold medal" once more, as a result of the research I am currently doing. I want only the gold; I dislike the silver and the bronze. I will leave these, if any medals at all, to those who rejected my papers, or tried to stop them from being published, a number of times even recently, under all kinds of silly pretexts, as well as those who intentionally or not have placed in my path all kinds of obstacles over the years. I will allow nobody to take it away from me this time.

References

1. Cronin B. Vining, "Former President's Salutation," *Thermoelectric News* 8, No.1, p.11, June (1996).

2. Chen Ning Yang, "Yang on Yang," exclusive interview for *Time* (1962).

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Excitation and Extraction of Vacuum Energy via EM-Torsion Field Coupling - Theoretical Model

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Abstract

An historical survey of torsion field research is given. One particular theory is singled out and described, which offers promise for direct coupling to the vacuum, via electromagnetic means, for the extraction of vacuum energy. Experimental protocols are suggested in the context of this theoretical model in order to achieve this goal.

Introduction

The author has spent some time researching the historical theoretical underpinnings as well as empirical exhibits of torsion fields, with an aim of determining the proper requirements that would allow artificial manipulation of vacuum energy by electromagnetic means. Part of this process has involved cataloguing the various anomalous energy signatures which have accompanied key electromagnetic research, such as the Zinsser kinetobaric effect which has been treated elsewhere.[1] Preliminary results from the analysis in the foregoing areas show some progress has been made towards this end. In the following, key developments along these lines will be explored in order to outline a theoretical model and to suggest preliminary experimental protocols for implementation of this knowledge.

Historical Perspective on Torsion Fields

Unlike other research results implying phenomena of an anomalous nature, the field of torsion research has an objective origin in formal theoretical physics with the history of gravitation theory. It is here that we will gain the best insight on how torsion fields and electromagnetic fields are linked.

Current notions of gravity are based upon a space-time geometrical description of the gravitational interaction. In the well-known General Relativity theory, introduced by Einstein in the early twentieth century, the space-time geometry is assumed to be that developed by Riemann. Here, gravitation is described by the metric tensor field (g_{uv}). A main conclusion of General Relativity theory is that space-time is curved or distorted, in response to a classical energy-momentum tensor due to the presence of mass.[2]

It was noticed that one of the ways to generalize General Relativity is to consider non-Riemannian space-times. One of the interesting theories developed along these lines describes the gravitational field by *two* independent geometric objects, the metric tensor field (g_{uv}) and the torsion field (Q_{uv}^{λ}). The torsion field tensor is defined as the anti-symmetric component of the non-symmetric affine connection (Γ_{uv}^{λ}), where $Q_{uv}^{\lambda} = 1/2\,(\Gamma_{uv}^{\lambda} - \Gamma_{vu}^{\lambda})$. This so-called Einstein-Cartan Theory (ECT), or Riemann-Cartan theory, went further than the Einstein theory in describing dynamic effects in space-time. It posited the existence of a physical object called the torsion of space-time, which occurred in response to the classical spin-angular momentum density of a rotating mass.[3] In geometric terms, the torsion of space-time expresses the axial polarization of intrinsic angular momentum of matter particles.

However, in the early development of the torsion theories, much psychological prejudice prevented an ongoing search for empirical exhibits of a torsion field. This was primarily due to ECT findings that if torsion existed, the theoretical constant of spin-torsion interaction would be proportional to the product of Gh (G = gravitational constant, h = Planck's constant). This value is almost 30 orders of magnitude weaker than gravitational interactions (the weakest of known physical forces), and thus would not be expected to contribute noticeably to observed phenomena.[4] Another barrier to examining empirical exhibits of torsion under the ECT theories was that torsion equations allowed only for an algebraic linkage between torsion and its spin source. In other words, in ECT, torsion is static, non-propagating, and is directly connected to the source. Thus, a torsion potential which is necessary for a dynamic description of physical forces is not permitted in ECT theories.

If torsion theory continued to exhibit such dubious contact with experiment, having been burdened with static nature and corresponding predictably infinitesimal coupling constants, it is unlikely that it would have had any significant impact on the advancement of science. However, numerous anomalies continued to surface in connection with both the quantum spin properties of elementary particles,[5] as well as with the macroscopic exhibits of angular momentum (polarization) aspects of electromagnetic waves,[6] that argued for a possible explanation in terms of a torsion field concept.

Finally, in the 70's and 80's, two new developments occurred in connection with torsion research that were responsible for a new resurgence in the field and a return to a study of torsion concepts in earnest by orthodox science. The first development was the consideration of a torsion field which was not rigidly attached to its spin source as in ECT, but one which could freely propagate through space. An exciting consequence of the application of this new model to astrophysical situations was the prediction of a non-stationary cosmology in which gravitational singularities could be avoided.[7] The second development was the serious investigation and ultimate validation of experimental exhibits of torsion fields by several groups in the former Soviet Union. An outgrowth of this study was the development of torsion generators,[8] as well as the evolution of a new model of the vacuum. This vacuum structure provided for interaction of particle-antiparticle pairs, producing different states of dynamic vacuum polarization which, on the macroscopic level, results in known physical forces.[9]

Torsion Field Model for Electromagnetic Vacuum Excitation

Since the introduction of General Relativity with spin and torsion into the physics literature in the early 70's,[10] many attempts have been made to construct a gauge-invariant theory of electramagnetism with torsion.[11] The main difficulty in this construction comes from the fact that the torsion of space-time, if one considers a minimal coupling between gravitation and electromagnetism, breaks the gauge-invariance of the theory. Another way of expressing this fact is the popular notion that standard EM waves (*e.g.*, photons) normally do not generate nor react to (*e.g.*, "feel") torsion.[10] One solution to this problem proposed modifying the gauge-invariance in order to allow for propagation of torsion.[12] However, this theory failed to strictly uphold the equivalence principle of General Relativity which has been established beyond doubt. Instead, this torsion theory predicted that different size masses would fall at different rates in the Earth's gravitational field. Then, in the early 80's, a prop-

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agating torsion model was advanced that both preserved gauge-invariance and also did not violate the equivalence principle. Instead, proposing a semi-minimal interaction between torsion and the electromagnetic field, this theory allowed for a minimal coupling between torsion and the virtual particle-antiparticle fermion pairs produced by a physical photon, according to the vacuum-polarization effect.[13] Thus, in this theory, which also agrees substantially with the proposed Russian vacuum structure,[8] photons are indirectly coupled to torsion preserving the necessary gauge-invariance. This theory, devised by De Sabbata and Gasperini, is the one that we will focus on in this report. Not only do its elements and conclusions tend to offer theoretical corroboration for the anomalous energy signatures recorded in various electromagnetic field research, but it will be seen to possess a mathematical structure which outlines a prescription for the generation of an electromagnetic field configuration which might possibly provide for actual artificial excitation and extraction of vacuum energy.

The structure of this theory presupposes a torsion potential (φ), whose gradient is the axial vector torsion (Q_μ). On the grounds of a semi-minimal coupling of the electromagnetic field tensor ($F_{\mu\nu}$) to the vacuum polarization tensor (details given in Reference 14), the following interaction Lagrangian is introduced,

$$\mathscr{L}_I = \frac{\sqrt{-g}}{16\pi}\,\alpha\eta^{\mu\nu\alpha\beta}A_\mu F_{\nu\alpha}Q_\beta\,, \qquad Q_\mu = \frac{1}{3!}\,\eta_{\mu\nu\alpha\beta}Q^{\nu\alpha\beta}\,. \tag{1}$$

The total Lagrangian, involving spinor (*e.g.*, fermion) sources as well as the EM-vacuum interaction (1) is,

$$\mathscr{L}_T = \frac{\sqrt{-g}}{16\pi}\left\{\frac{R}{G} + \frac{3}{2G}\,\partial_\mu\varphi\partial^\mu\varphi - F_{\mu\nu}F^{\mu\nu} - \eta\alpha^{\mu\nu\alpha\beta}A_\mu F_{\nu\alpha}\partial_\beta\varphi - \right.$$
$$\left. - 16\pi\left[\frac{1}{2}\,(\bar\psi\gamma^\mu\psi_{|\mu} - \bar\psi_{|\mu}\gamma^\mu\psi) + m\bar\psi\psi - ieA_\mu J^\mu - i\,\frac{3}{4}\,\partial_\mu\varphi J_5^\mu\right]\right\}, \tag{2}$$

where $\boldsymbol{F_{\mu\nu} = A_{\nu|\mu} - A_{\mu|\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu}$.

$$J^\mu = \bar\psi\gamma^\mu\psi,\ \ J_5^\mu = \bar\psi\gamma^\mu\gamma_5\psi \ \text{ and } \ \gamma_5\gamma_\nu = (i/3!)\,\eta_{\mu\alpha\beta\nu}\gamma^\mu\gamma^\alpha\gamma^\beta.$$

This Lagrangian is invariant under the local gauge transformations,

$$A_\mu \to A'_\mu = A_\mu + \partial_\mu\Lambda(x)\,. \tag{3}$$

$$\psi_{|\mu} \to \psi_{|\mu} - ieA_\mu\psi\,, \qquad \bar\psi_{|\mu} \to \bar\psi_{|\mu} + ieA_\mu\bar\psi \tag{4}$$

The torsion potential (φ) is coupled in a minimal way to the spinor field (ψ), and in a semi-minimal way to the electromagnetic field.

From independent variation of ψ, $\bar\psi A_\mu$, and φ, we obtain the field equations for the charged-matter field, the electromagnetic field and the torsion potential,

$$\gamma^\mu\psi_{|\mu} - ieA_\mu\gamma^\mu\psi - i\,\frac{3}{4}\,\partial_\mu\varphi\gamma^\mu\gamma_5\psi - m\psi = 0\,, \tag{5}$$

$$\bar\psi_{|\mu}\gamma^\mu + ieA_\mu\bar\psi\gamma^\mu + i\,\frac{3}{4}\,\partial_\mu\varphi\bar\psi\gamma^\mu\gamma_5 - m\bar\psi = 0\,, \tag{6}$$

$$F^{\mu\nu}{}_{|\nu} = 4\pi ieJ^\mu + \frac{\alpha}{2}\,\eta^{\mu\nu\alpha\beta}F_{\nu\alpha}\partial_\beta\varphi\,, \tag{7}$$

$$\varphi^{|\mu}{}_{|\mu} = \frac{G\alpha}{6}\,\eta^{\mu\nu\alpha\beta}F_{\mu\nu}F_{\alpha\beta} - 4\pi iGJ^\mu{}_{5|\mu}\,. \tag{8}$$

Therefore torsion is a propagating field since its potential obeys a wave equation (8). This equation can be simplified in the flat space approximation and in the absence of spinning matter to become,

$$\Box\varphi = \frac{G\alpha}{6c^4}\,\varepsilon^{\mu\nu\alpha\beta}F_{\mu\nu}F_{\alpha\beta}\,, \tag{9}$$

Electromagnetic production of torsion is allowed, then, even in the absence of other torsionic sources like spinning particles or polarized macroscopical bodies. Now, taking the static limit of (9), we arrive at the following important result, where E = Electric field intensity, B = Magnetic field intensity,

$$\nabla^2\varphi = -\frac{4}{3}\,\frac{G\alpha}{c^4}\,\boldsymbol{E}\cdot\boldsymbol{B}\,. \tag{10}$$

This is the key equation that we will need, showing that any electromagnetic field with the property $\mathbf{E}\cdot\mathbf{B} \neq 0$, apparently can serve as a source of torsion potential. Thus, from theoretical considerations, torsion waves can be generated using polarized electromagnetic radiation.

However, a single plane wave cannot be a torsionic source according to Equation (10), since it satisfies $\mathbf{E}\cdot\mathbf{B} = 0$. This is in agreement with the fact that the photon-torsion coupling is due to the vacuum polarization effect, and there is no linear vacuum polarization for a traveling EM wave in empty space. Therefore, an EM wave must propagate through another EM medium in order to produce torsion.

We will now show that two intersecting polarized plane EM waves can produce a scalar torsion potential, in much the same way that Bearden proposed with the process he termed "scalar interferometry," where a scalar wave form can result from the coupling of two standard EM waves. We consider the highly idealized situation in which two electromagnetic plane waves are propagating at a right angle. The first wave is linearly polarized along the x-axis and it is propagating along the z-axis with a frequency ω_1. The EM field is then,

$$\begin{cases} \boldsymbol{E}_1 = (A_1,\,0,\,0)\,\exp\,[i(k_1 z - \omega_1 t)]\,, \\ \boldsymbol{B}_1 = (0,\,A_1,\,0)\,\exp\,[i(k_1 z - \omega_1 t)]\,. \end{cases} \tag{11}$$

The second wave is polarized along the z-axis and it propagates along the y-axis with a frequency ω_2,

$$\begin{cases} \boldsymbol{E}_2 = (0,\,0,\,A_2)\,\exp\,[i(k_2 y - \omega_2 t)]\,, \\ \boldsymbol{B}_2 = (A_2,\,0,\,0)\,\exp\,[i(k_2 y - \omega_2 t)]\,, \end{cases} \tag{12}$$

where A_1 and A_2 are the amplitudes of the waves, and k_1 and k_2 are related to the frequencies by,

$$\boldsymbol{k}_1 = \left(0,\,0,\,\frac{\omega_1}{c}\right), \qquad \boldsymbol{k}_2 = \left(0,\,\frac{\omega_2}{c},\,0\right) \tag{13}$$

Note that we have neglected, in first approximation, the deviation from unity of the refractive index of the vacuum due to presence of an EM field.

The total density of "torsionic charge," (**E.B**) is then,

$$(\boldsymbol{E}_1 + \boldsymbol{E}_2)\cdot(\boldsymbol{B}_1 + \boldsymbol{B}_2) = A_1 A_2\,\exp\,[i(k_2 y + k_1 z - \omega_1 t - \omega_2 t)]\,. \tag{14}$$

(Notice that the polarization mode is crucial for the possibility of torsion production). The standard procedure of Fourier transform provides the following solution of Equation (10):.

$$\varphi(\boldsymbol{x},\,t) = -\frac{2}{3}\,\frac{G\alpha}{c^2}\,\frac{A_1 A_2}{\omega_1\,\omega_2}\,\exp\,[i(k_2 y + k_2 z - \omega_1 t - \omega_2 t)]\,. \tag{15}$$

The torsion potential is then a monochromatic scalar wave,

$$\varphi = A\,\exp\,[i(\boldsymbol{k}\cdot\boldsymbol{x} - \omega t)] \tag{16}$$

with a frequency $\omega = \omega_1 + \omega_2$, a propagation vector $\mathbf{k} = (0,k_1,k_2)$, and an amplitude $A = (2G\alpha A_1A_2/3c^2\omega_1\omega_2)$. The torsion wave propagates then in the (y, z)plane at an angle δ with the y-axis,

$$\delta = \operatorname{arctg} k_1/k_2 = \operatorname{arctg} \omega_1/\omega_2 \tag{17}$$

and the space filled with EM radiation behaves like a dispersive medium for the propagation of torsion, according to the following dispersion relation,

$$\omega(k) = ck(1 + 2\omega_1\omega_2/c^2k^2)^{\frac{1}{2}}\,. \tag{18}$$

Considerations for Realization of the Model

With the above theoretical model, it would appear that the generation of a classical electromagnetic wave with the proper-

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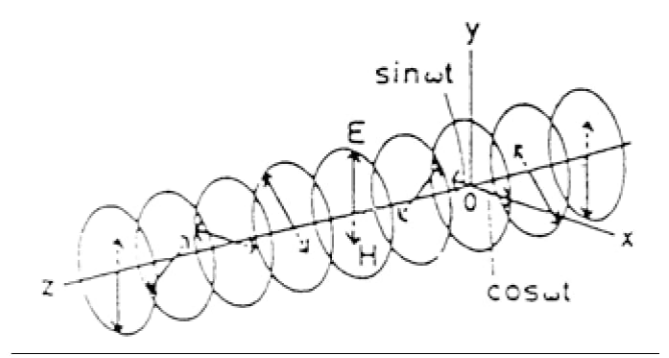

Figure 1A. Helical distribution of linearly oscillating parallel electric and magnetic fields shown by solid and broken arrows, respectively.

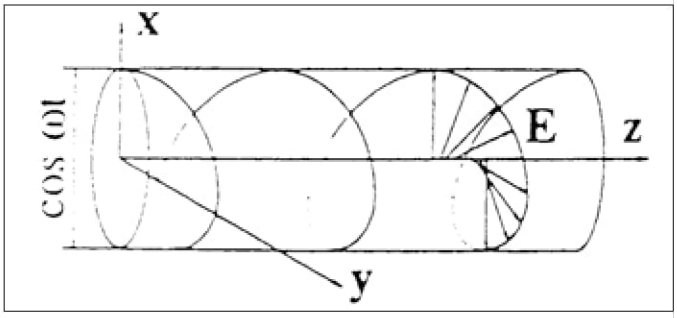

Figure 1B. Electric field distribution of a helicoidally polarized standing wave. The magnetic field B (not shown) is parallel to E and oscillates in time in quadrature with E.

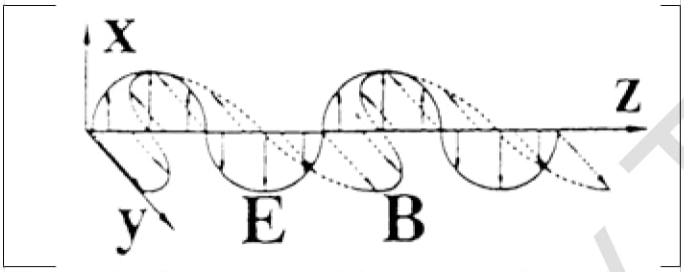

Figure 1C. Electric (solid line) and magnetic (dashed line) field distributions of a linearly polarized standing wave.

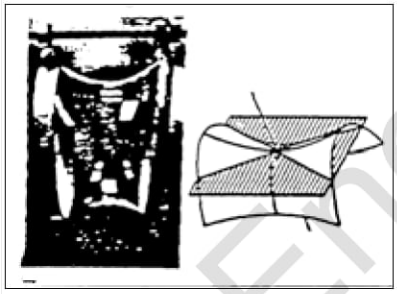

Figure 2A. Soap films as minimal surfaces.

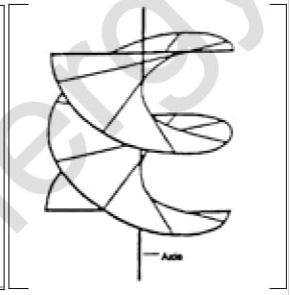

Figure 2B. Generation of helicoid.

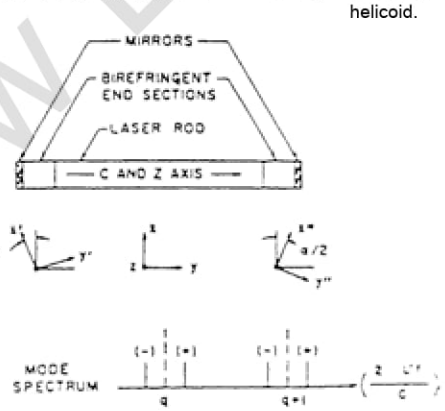

Figure 3. Construction and mode spectrum of a "twisted-mode" laser resonator.

ty, $\mathbf{E}\cdot\mathbf{B} \neq 0$, can provide a coupling to torsion fields. However, the realization of this proposed model, utilizing two laser beams at right angles, for instance, in a laboratory setting is problematical chiefly because the model described is ideal. We have failed to consider the factor of the refractive index of the medium which must be taken into account whenever we have a linearly polarized EM radiation propagating through another EM medium. A more realistic situation is to replace the second plane wave with a static electric or magnetic field, which is different from zero and constant only in a restricted region.[15] The fact that Russian findings have established that any electrostatic field possesses two chiral torsion field components justifies this proposition.[9] Just such a similar EM field configuration was a feature with the Hutchison lift and disruption effect, where inexplicable levitation and/or catastrophic fracturing occurred to various masses placed within the target area.[16] Here, the EM milieu included both RF effects from Tesla Coils, oscillators, radioactive sources, as well as electrostatic fields from Van de Graaff generators with toroidal/spherical capacitor terminals.[16]

Perhaps it might be possible to obtain the torsion-coupling effect more readily with a single EM source. In this regard, similar unaccountable inertial anomalies occurred in conjunction with the Zinsser "kinetobaric effect," in which sharply pulsed microwave EM energy was applied to electrodes immersed in water.[1] According to our theoretical model, this would entail the generation of a field configuration in which $\mathbf{E}\cdot\mathbf{B} \neq 0$. While such a field relation is counter to all standard single transverse EM waves (TEM) in which $\mathbf{E}\cdot\mathbf{B} = 0$, nevertheless recently classical TEM waves in which the **E** and **B** vectors are parallel ($\mathbf{E}\cdot\mathbf{B} \neq 0$), have been theoretically predicted,[17] disputed,[18] and subsequently shown to exist.[19] These waves are quite unique in structure. First of all it was found for one representation of this wave type; the magnetic vector potential (**A**) satisfies a so-called Beltrami vector field equation (*e.g.*, curl**A** = k**A**, where k is a pseudoscalar). Such vortical type vector fields are fascinating in their own right and are currently being studied for novel applications in many areas of science.[20] At any rate, besides this geometric feature, or possibly because of it, $\mathbf{E}\,||\,\mathbf{B}$ waves possess a specialized topology which describes a helical standing (or more accurately—stationary) wave. Consequently, every plane wave solution corresponds to two circularly polarized waves propagating opposite to each other and combining to form the helical stationary wave. It is appropriately termed "stationary" since this wave does not possess the standard non-zero Poynting power flow feature of standard TEM waves with $E \perp B$, but propagates magnetic helicity. Magnetic helicity is purely a topological feature of fluid like systems and appears often associated with non-linear aspects of high-density plasmas,[21] and turbulent fluid motion.[22] The geometry of this wave is shown in Figure 1-A, B. In comparison, Figure 1-C is a depiction of a linearly-polarized standing wave with perpendicular **E** and **B** vectors. Notice that the helically-polarized stationary wave is composed of electric and magnetic fields distributed along a spatially constant amplitude helix. Also, unlike the linearly-polarized wave, the TEM wave with $\mathbf{E}\,||\,\mathbf{B}$ exhibits no nodes. In this regard, the latter wave traces out in space and time a configuration which is identical to the plane surface of minimal area known as the helicoid. See Figure 2a for a picture of this surface. This unique field configuration has been experimentally realized in the "twisted mode" technique for obtaining uniform energy density in a laser cavity.[23,24] Figures 3, 4, 5, and 6 show different experimental arrangements to produce the $\mathbf{E}\,||\,\mathbf{B}$ stationary wave. Those with such apparatus are urged to experiment further.

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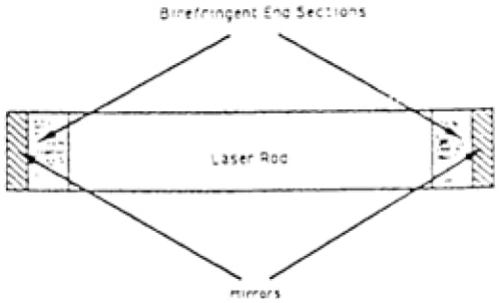

Figure 4. The configuration of a ruby laser proposed by Evtuhov and Siegman (1965) which realizes E//B TEMSW.

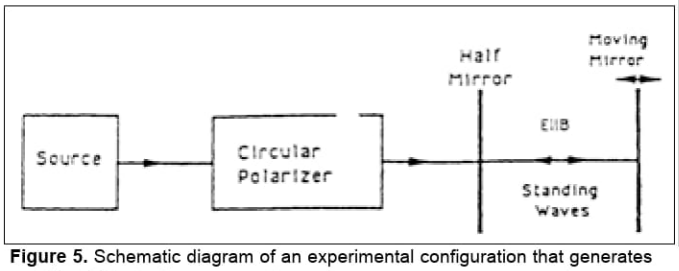

Figure 5. Schematic diagram of an experimental configuration that generates an E//B TEM standing wave pattern.

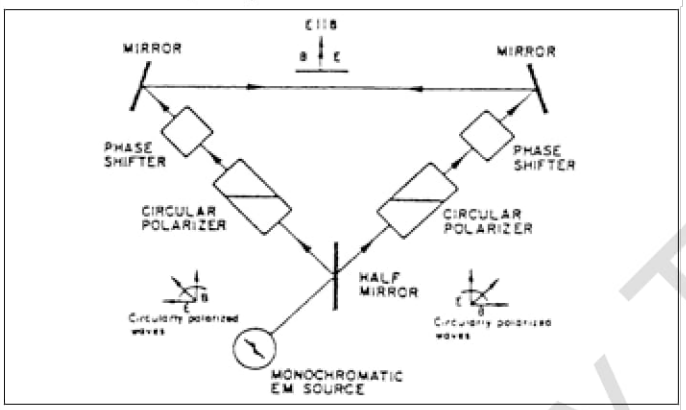

Figure 6. Schematic diagram of an experimental configuration that generates an E//B TEM standing-wave pattern.

Topological Considerations for EM Waves with $\mathbf{E}\cdot\mathbf{B} \neq 0$

Artificial electromagnetic coupling to torsion fields, with accompanying excitation of the vacuum and extraction of useful energy in the process, can thus possibly only be accomplished by the generation of specially crafted EM waves exhibiting multiply-connected soliton-like topology and possessing the key relation, $\mathbf{E}\cdot\mathbf{B} \neq 0$.

Although they have been little studied, empirical classical electromagnetic structures displaying the features of closed finite-energy wave-packets have appeared in recent history dating from Tesla's research. Particularly, in the waning years of the twentieth century, with the development of high-power plasma generating devices in conjunction with fusion research, and high-intensity lasers whose operation can only be described with the aid of vacuum polarization phenomena predicted by quantum field theory, evidence continues to surface which clearly demonstrates inaccuracies from the linear Maxwell theory in the classical arena when extremely high energy intensities are involved. As case in point, the existence of EM soliton singularities has been demonstrated in recent years with Shoulders' discovery of condensed charge-cluster EV units,[25] and the important but overlooked observation of closed spark loops in high-voltage electrostatic discharges at the Holifield Heavy Ion Research Facility at Oak Ridge National Laboratory.[26,27,28] In the latter case, below 10 MV (megavolts) the discharges resemble those of normal forked lightning. However, above this threshold, the discharges' topology changes dramatically. Here, at peak machine voltage (@ 20 MV), these structures have been ascertained as genuine multiply-connected closed-loop configurations, and not the accidental visual superposition of simply-connected spiral discharges.[26] Traditionally, Maxwell's linear theory is supposed to subsume all exhibits of classical electrodynamics, regardless of the level of energy or charge-density of the field. However, the new spark discharge evidence and the Shoulders' research both indicate that there may actually exist, hitherto unsuspected, separate regimes of classical electrodynamics in high energy-density plasmas, demarcated by a voltage phase transition.[28] Above this barrier of potential, finite closed energy wave-structures may exist which cannot be codified by the linear Maxwell field theory. Theoretical justification for the existence of classical EM wave packets has been examined in the key research by Barrett in which higher symmetry groups utilizing non-Abelian quaternion algebra (SU(2) Yang-Mills fields) are invoked, implying a non-Abelian extension of Maxwell's equations.[29] This topic has been treated by the present author elsewhere, where a toroidal model is speculated on for both the Shoulders' charge-cluster units and the closed spark loops.[30]

However, for our purposes in the present exposition, we wish to emphasize that the EM field structure obeying the relation $\mathbf{E}\cdot\mathbf{B} \neq 0$, in contrast to the latter experiments, can be generated with relatively small energy input.[24] Moreover, Kiehn has shown that the proper description of the characteristics and dynamics of classical EM waves with $\mathbf{E}\cdot\mathbf{B} \neq 0$ satisfying Maxwell's equations, require the use of the topological postulates expressed in terms of Cartan's theory of differential forms.[31] We will explore the major implications of his key conclusions for our needs here, and refer the reader to Reference 32 for the details.

In general, for a standard Lorentz vacuum, the speed of energy flow in an EM field is the speed of light. However, as Kiehn shows, for a wave with $\mathbf{E}\cdot\mathbf{B} \neq 0$ speed of energy, flow can be less than light speed. In fact, due to non-vanishing magnetic helicity the four-vector potential cannot be described by less than four linearly independent functions over the space-time domain. This can be put into correspondence with four different helical solutions to Maxwell's equations, two right-handed modes propagating with different phase velocities in opposite directions, and two left-handed modes propagating in opposite directions with two other distinctly different phase velocities. These four-mode solutions have been observed in ring-laser experiments by Sanders in 1977.[33] Moreover, one important feature of these four-mode waves is their ability to couple to a chiral vacuum structure.[34] Thus, perhaps there is a key hitherto unnoticed connection between electromagnetism, the vacuum impedance of free space, and the inherently chiral torsion field structure.[8] In the next section we examine established torsion field characteristics, as well as other speculated ones, that might indicate signatures of EM-torsion field coupling.

Possible Effects of Torsion Wave Coupling

One major characteristic of torsion fields is their unique ability to leave a "ghost-field" imprint on the polarized vacuum of space once the original excitation has been removed.[9] Experimenters should check for this property with $\mathbf{E}\,||\,\mathbf{B}$ waves. Secondly, it is speculated that torsion fields from the polarized vacuum can interact with the inertial fields of masses.[4] Recently, support for this hypothesis has been given by Puthoff *et al.*, demonstrating theoretically that the property of inertia might not be an inherent property of matter, but a derivative property of the fluctuating zero-point EM energy vacuum fields of nature.[35] If proven, this thesis could provide an explanation for the Zinsser kinetobaric effect and Hutchison's lift and disruption phenomena as well. Also, since the torsion potential of our model is a function of the gravitational constant (Equation 10), one could, in addition, possibly expect to observe a distortion in

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either gravitational potential or pace of time in the proximity of a torsion ray or beam. A similar effect was noted by W. Smith as an adjunct to the energy production in his caduceus-wound coils.[36] A noticeable change in the half-life of a radioactive substance or alteration in the mass of an object could provide such a test. Since the torsion field produces the attraction of like charged fields,[4] this unique property could provide an explanation for the formation and persistence of Shoulders' charge-cluster units in which the Coulomb barrier is breached.[37] Moreover, if the charge-cluster units are a solitonic product of torsion coupling, then torsion fields represent a quantized vacuum impedance having a definite speed, direction, and spin (chirality), which can be topologically structured by specific electromagnetic geometries,[29] or high-intensity abrupt spark discharges.[26]

Conclusion

The recent Russian research findings on torsion fields holds promise for providing the connecting link between different modes of microscopic vacuum polarization and the known macroscopic physical forces of nature. For instance, there is preliminary evidence to suggest a more comprehensive understanding might be forthcoming regarding the dynamics of electromagnetic fields at a more fundamental level of nature and their mode of interaction with the vacuum, which obviates the necessity for a quantum mechanical treatment. However, such research is merely in its infancy. Consequently, the associated ideas examined in this paper should be taken as preliminary and far from definitive. Perhaps with appropriate future experimental corroboration, amplification, clarification and refinement, they can then be integrated formally into theoretical and empirical science.

References

1. W. Peschka, 1996. "Kinetobaric Effect as Possible Basis for a New Propulsion Principle," *Raumfahrtforschung*, Feb. 1974; trans. by D. Reed In: *Mechanical Energy from Gravitational Anisotropy*, Integrity Research Institute, Washington, DC.; also *Infinite Energy* No. 22, pp. 52-56.

2. C. Misner, K. Thorne, J. Wheeler, 1973. *Gravitation*, W.H. Freeman & Co., San Francisco.

3. T. Kibble, "Lorentz Invariance and the Gravitational Field," *J. Math. Phys.*, N 2, p. 212, 1961; D. Sciama, "The Physical Structure of General Relativity," *Rev. Mod. Phys.*, No. 36, p. 463, 1964; F. Hehl, "Spin and Torsion in General Relativity I: Foundations," *Gen. Rel. Grav.*, N 4, p. 333.

4. A. Akimov and G. Shipov, 1996. "Torsion Fields and Their Experimental Manifestations," *Proc. Int. Conf. on New Ideas in Natural Sciences*, St. Petersburg.

5. A. Krish, 1987. " The Spin of the Proton," *Scientific American*, No. 10, p. 12.

6. C. Imbert, "Calculation and Experimental Proof of the Transverse Shift Induced by Total Internal Reflection of a Circularly Polarized Light Beam," *Phys. Rev. D*, Vol. 5, No. 4, p. 787, 1972; A. Tam, W. Happer, "Long-Range Interaction Between CW Self-Focused Laser Beam in an Atomic Vapor," *Phys. Rev. Lett.*, Vol. 38, No. 6, p. 278.

7. W. Kopczynski, "A Non-Singular Universe with Torsion," *Phys. Lett. A*, Vol. 39, p. 219, 1972; A. Trautman, "On the Einstein-Cartan Equations," *Symp. Math.*, Vol. 2, No. 1, p. 139, 1973.

8. A. Akimov, 1997. "Heuristic Discussion of the Problem of Finding Long Range Interactions, EGS Concepts," *Jour. New Energy*, Vol. 2, No. 3-4, p. 55.

9. A. Akimov and V. Tarasenko, 1992. "Models of Polarized States of the Physical Vacuum and Torsion Fields," *Sov. Phys. Jour.*, p. 214, March.

10. F. Hehl *et al.*, 1976. "General Relativity with Spin and Torsion: Foundations and Prospects," *Rev. Mod. Phys.*, Vol. 3, p. 393.

11. L. Smalley, 1988. *Phys. Lett. A* , Vo1. 117, p. 267, 1986; R. Hammond, Gen. Rel. Grav., Vol. 20, p. 813.

12. S. Hojman *et al.*, 1978. "Gauge Invariance, Minimal Coupling, and Torsion," *Phys. Rev. D*, Vol. 17, No. 12, p. 3141.

13. V. De Sabbata, M. Gasperini, 1981."A Gauge-Invariant Interaction Between a Charged Spinor Field and a Propagating Torsion Field," *Lett. Nuovo Cim.*, Vol. 30, No. p, 193, Feb.

14. V. De Sabbata, M. Gasperini, "A Semi-Minimal Coupling Principle for the Electromagnetic Field in a Space with Torsion," *Lett. Nuovo Cim.*, Vol. 28, No. 7, p. 229, June 1980.

15. V. De Sabbata, M. Gasperini, 1981. "Torsion Production by Electromagnetic Fields," *Lett. Nuovo Cim.*, Vol. 30, No. 12, p. 365, March.

16. J. Hutchison, 1994. "The Hutchison Effect Apparatus," *Proc. 1st Int. Symp. on New Energy*, Denver, p. 191, May.

17. C. Chu, T. Ohkawa, 1982. "Transverse Electromagnetic Waves with E // **B**," *Phys. Rev. Lett.*, Vol. 48, No. 13, p. 837.

18. K. Lee, 1983. "Comments on 'Transverse Electromagnetic Waves with E // B, '" *Phys. Rev. Lett.*, Vol. 50, No. 2, p. 138.

19. K. Shimoda *et al.*, "Electromagnetic Plane Waves with Parallel Electric and Magnetic Fields **E** // **H** in Free Space," *Am. Jour. Phys.*' Vol. 58, No. 4, p. 394, 1990; F. Bretenaker, A. Le Floch, 'Nonlinear Intensity Effects in a Laser Generating the Three Main Standing Waves," *Phys. Rev. A*, Vol. 43, No. 7, p. 3704, 1991.

20. D. Reed, "The Vortex as Topological Archetype- A Key to New Paradigms in Physics and Energy Science," *Proc. 4th Int. Symp. of New Energy*, Denver, p. 207, 1997;...,"Foundational Electrodynamics and Beltrami Vector Fields," In: T. Barrett, D. Grimes (eds), Advanced Electromagnetism: Foundations, Theory and Applications, World Scientific, Singapore, p. 217, 1995; "Archetypal Vortex Topology in Nature," *Speculat. Sci. Technol.*, Vol. 17, No. 3, p. 206, 1994.

21. K. Nishikawa, M. Wakatani, *Plasma Physics: Basic Theory with Fusion Applications*, Springer-Verlag, Berlin, 1990; M. Berger, G. Field, " The Topologica1 Properties of Magnetic Helicity," *Jour. Fl. Mech.* Vol. 147 no. 133, 1984; A. Ranada, "On the Magnetic Helicity, *Eur. Jour. Pnys.*, Vol. 13, p. 70, 1992.

22. H. Moffatt, " The Degree of Knottedness of Tangled Vortex Lines," *Jour. Fl. Mech.*, Vol. 35, p. 117, 1969; M. Lesieur, *Turbulence in Fluids*, 2nd Ed., Kluwer Academic, Dordrecht, Netherlands, 1990.

23. H. Zaghoul, O. Barajas, 1990. "Force-Free Magnetic Fields," *Am. Jour. Phys.*, Vol. 53, No. 8, p. 783.

24. V. Evhutov, A. Siegman, "A Twisted Mode Technique for Obtaining Axially Uniform Energy Density in a Laser Cavity," *App. Optics*, Vol. 4, No. 1, p. 142, 1965.

25. K. Shoulders, U.S. Patent #5,018,180, "Energy Conversion Using High Charge Density," issued 21 May 1991.

26. I. Alexeff, M. Rader, "Possible Precursors of Ball Lightning: Observation of Closed Loops in High-Voltage Discharges," *Fusion Technology*, Vol. 27, p. 271, May 1995.

27. I. Alexeff, M. Rader, "Observation of Closed Loops in High-Voltage Discharges: A Possible Precursor of Magnetic Flux Trapping," *IEEE Trans. on Plasma Sci.*, Vol. No. 6, p. 669, Dec. 1992.

28. I. Alexeff, M. Rader, "Observations of Closed Current Loops in High Power Arcs," *Proc. 19th Int. Conf. Plasma Sci.*, Tampa, F1., p. 158, June 1992.

29. C. Yang, R. Mills, "Conservation of Isotopic Spin and Isotopic Gauge Invariance," *Phys. Rev.* Vol. 96, p. 191, 1954; T. Barrett, "Electromagnetic Phenomena Not Explained by Maxwell's Equations," In: A. Lakhtakia (ed), *Essays on the Formal Aspects of Electromagnetic Theory*, World Scientific, Singapore, 1993.

30. D. Reed, 1997. "Novel Electromagnetic Concepts and Implications for New Physics Paradigms and Energy Technologies," *Jour. New Energy*, Vol. 2, No. 1, p. 69.

31. H. Flanders, *Differential Forms with Applications to the Physical Sciences*, Dover Pub., New York, 1989.

32. R. Kiehn, "Maxwell Faraday and Maxwell Ampere Equations," unpublished work, 1997; ..., "Electromagnetic Waves in the Vacuum which have Torsion and Spin," unpublished work, 1997;..., "Topology and Topological Evolution of Electromagnetic Fields and Currents," unpublished work, 1998.

33. V. Sanders, R. Kiehn, *Jour. Quantum Electron.*, Vol. QE-13, p. 739, 1977.

34. R. Kiehn, "The Chiral Vacuum," unpublished work, 1997; Internet Website: http://www.uh.edu/~rkiehn; W. Rodrigues, J.-Y. Lu, "On the Existence of Undistorted Progressive Waves of Arbitrary Speeds $0 < v < \infty$ in Nature," *Found. Phys.*, Vol. 27, No. 3, p. 435, Mar. 1997.

35. B. Haisch, A. Rueda, H. Puthoff, 1994. "Inertia as a Zero-Point Field Lorentz Force," *Phys. Rev. A* , Vol. 49, No. 2, p. 678.

36. W. Smith, 1964. *The New Science*, Thornton Pub.

37. K. Shoulders, *EV: A Tale of Discovery*, Austin, TX, 1989; K. Shoulders, S. Shoulders, "Observations on the Role of Charge Clusters in Nuclear Cluster Reactions," *Jour. of New Energy*, Vol. 1, No. 3, Fall 1996.

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Don Reed has a Master of Arts degree in Mathematics and a background in physics and electrical engineering, and has taught mathematics at both the high school and college levels. Over the years he has had an abiding interest in fundamental theories of the universe and has also pursued research in the field of nonconventional and advanced energy technology for the last twenty-five years. He has been published in many journals such as *Energy Unlimited, Extraordinary Science, Journal of New Energy, Space Energy Journal, Speculations in Science and Technology*, and has authored a chapter in the recent book: *Advanced Electromagentism: Foundations, Theory and Applications*, published by World Scientific in 1995. He also has had several papers printed in the Proceedings for various conferences on non-conventional energy technology.

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THE SOURCE OF EXCESS ENERGY FROM WATER

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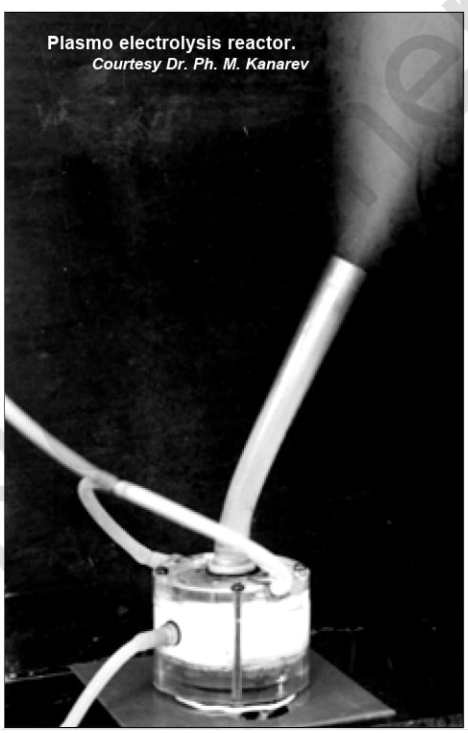
It is a great honor and pleasure for me to write this paper at the suggestion of *Infinite Energy's* editor, Dr. Eugene Mallove. *Infinite Energy* is a wonderful journal, because it provides scientists with theoretical information with complex mathematical formulae regarding the new sources of energy, information for engineers, and popular information accessible to many others.

There are many publications[5,6,8,9,11,12,13,14] regarding the generation of excess energy from *water* by using different processes, such as low voltage electrolysis, plasma electrolysis, cavitation (by processing water with ultrasound), etc.

In all of these cases, very complex physico-chemical phenomena take place, and the essence of these is not yet understood. However, it is known that the participants in these processes are: photons, electrons, atoms of hydrogen, oxygen, molecules of water, and in some cases, molecules of acids or bases. To these we have to add, for the electrochemical processes, the elements which constitute the materials of the anodes and cathodes.

The release of excess energy from water by using different methods of processing can be considered as demonstrated and the task is now to discover the source of this energy. In order to make the following more clear, I will omit numerous mathematical and chemical formulae and their derivation. I will use only those which are absolutely necessary for understanding the essence of the problem. Those interested in the details can find them in my books.[2,10,14]

The main carriers of thermal energy are the photons and the electrons. The energy is accumulated in the electrons and is transferred from an electron to other photons. How can this be comprehended with the greatest precision? The answer is almost unambiguous: from the spectra of the atoms and ions. More than 150,000 spectral lines of atoms and ions have been established experimentally by physics and chemistry. However, today we can calculate theoretically with great precision only the spectra of the hydrogen-like atoms, that is those atoms which have a singular electron. The spectra of all other electrons are now calculated numerically with methods of approximation which can give satisfactory results, but are not able to reveal the physical basis of the phenomena.



Plasmo electrolysis reactor.
Courtesy Dr. Ph. M. Kanarev

The question arises whether it is possible to find an analytical mathematical formula which allows the calculation of the spectra of all electrons or at least of the majority of them, and at the same time explains the process of interaction of the electron with the nucleus at the moment of emission or absorption of a photon? Yes, it can be shown that this is possible. This formula can be found from the analysis of the spectrum of the hydrogen atom, which is the simplest of all. It is formed from a proton, which is simultaneously the nucleus and one single electron. In order to remove the electron from the nucleus of the atom, we have to consume E_i = 13.6 eV. This is the ionization energy of the atom. It is equal to the energy of binding of the electron with the proton at the moment when the electron is placed at the first energy level, at the shortest distance from the nucleus.[14]

When the electron absorbs a photon with the energy of F = 10.6 eV, it goes to the second energy level and its binding energy becomes equal to E_b = 3.4 eV. Because by absorption of the photon its energy adds to the energy of the electron, we have to describe this process as:

$$13.6\text{eV} + 10.2\text{eV} = 3.4\text{eV} \quad (1)$$

This result is given by the experiment, however it contradicts common sense and elementary mathematics. In order to eliminate this contradiction, physicists had to suppose that the energy of the electron in the atom is negative and (1) can be written as:

$$-13.6\text{eV} + 10.2\text{eV} = -3.4\text{eV} \quad (2)$$

Thus, mathematical logic was regained. However, the physical logic is not clear yet. It can be supposed that the potential energy of the electron in the atom is negative, but it has kinetic energy too, and this cannot be negative. However, this physical contradiction was accepted and forgotten.

Actually, the expression (2) not only contradicts the positive nature of the kinetic energy but it also does not contain the total energy of the electron which, as is known, is equal to:

$$E = mc^2 = 5.111 \cdot 10^5\text{eV} \quad (3)$$

If we consider this, the expression (2) becomes:

$$5.111 \cdot 10^5\text{eV} - 13.6\text{eV} + 10.2\text{eV} = 5.111 \cdot 10^5\text{eV} - 3.4\text{eV} \quad (4)$$

In this formula we use the symbols:

$$E_0 - E_i + F = E_0 - \frac{E_1}{n^2}. \quad (5)$$

Here $E_1 / n^2 = E_b$ is the energy of binding of the electron to the nucleus, n=2,3,4... is the number of the energy level of the electron in the atom or its principal quantum number.

Considering that the ionization energy E_i of the hydrogen atom is equal with energy of binding E_1 of the electron at the moment of its presence in the first energy level, the formula (5) can be written as:

$$F = E_i - \frac{E_1}{n^2} \quad (6)$$

This is the mathematical expression for the formation of spectra of atoms and ions. Using it we can calculate the energy of binding E_b .

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Table 1. The spectrum of the electrons of the hydrogen atom and the energy E_b of its bond with the proton and the distance R_i between them.

Quantum number	n	2	3	4	5	6
F (exper.)	eV	10.20	12.09	12.75	13.05	13.22
F (theor.)	eV	10.198	12.087	12.748	13.054	13.22
E_b (theor.)	eV	3.40	1.51	0.85	0.54	0.38
R_i (theor.)	$\cdot 10^{-10} m$	4.23	9.54	16.94	26.67	37.89

This calculus is known, however until recently it was not known if the formula (6) can be used for the calculus of the second and further electrons, starting from the nucleus of the atom. It has been stated as possible, in case that it is known that the energy E_1 of bonding the electron to the nucleus corresponds to its first energetic level. We will not describe here the method of calculus of this energy for the atoms and ions with many electrons, but will give only the results of this calculus only for those electrons, the spectra of which are used by us for the analysis of the sources of excess energy.

The ionization energy of the eighth electron of oxygen is E_i = 13.618 eV, and the energy E_1 corresponding to its binding to the nucleus of the atom, corresponding to the first level of energy is E_1= 13.752 eV. The values of the energy parameters of this electron according to the formula (6) are given in Table 2.

Table 2. The spectrum of the eighth electron of the oxygen atom and the energy E_b of its bond with the nucleus.

Quantum number	n	2	3	4	5	6
F (exper.)	eV	10.18	12.09	12.76	13.07	13.24
F (theor.)	eV	10.16	12.09	12.76	13.07	13.24
E_b (theor.)	eV	3.44	1.53	0.86	0.55	0.38

The energy of ionization of the seventh electron of the oxygen atom is E_1 = 35.116 eV and the energy of its binding to the nucleus, corresponding to the first energy level, is E_1 = 83.98 eV.

Table 3. The spectrum of the seventh electron of the oxygen atom and the energy of its bond with the nucleus.

Quantum number	n	2	3	4	5	6
F (exper.)	eV	14.87	25.97	29.65	31.62	32.90
F (theor.)	eV	14.87	26.12	30.05	31.88	32.87
E_b (theor.)	eV	20.24	9.00	5.06	3.24	2.25

In the experiments described later, sodium hydroxide is also used, and therefore we also need the spectrum of the eleventh electron of sodium. Its ionization energy is E_i = 5.139 eV, and its binding energy corresponding to the first energy level is E_1 = 13.13 eV. The calculus of its spectrum is presented in Table 4.

Table 4. The spectrum of the eleventh electron of the sodium atom and its energy of binding to the nucleus.

Quantum number	n	2	3	4	5	6
F (exper.)	eV	2.10	3.68	4.31	4.62	4.78
F (theor.)	eV	1.86	3.68	4.32	4.61	4.77
E_b (theor.)	eV	3.28	1.46	0.82	0.52	0.36

By analyzing the values of binding energies of the valence electrons of the atoms shown, we can state that for the electron of the atom of hydrogen, for the eighth electron of the atom of oxygen, and for the eleventh electron of the atom of sodium, these have almost the same values for the same energy level n. This suggests the equal probability for these electrons to form bonds with each other and the probabilities of these bonds being destroyed by external electrical fields.

A more detailed description of these data leads to a complete book, not only a paper for a journal! We are presenting, therefore, the final conclusions of this search. The analysis of the laws of formation of the spectra shows that the electrons in the atoms do not have an orbital movement, and in the formula (6) there is no orbital component of its energy. In this formula there is only the rotation energy of the photon and the electron moving around their axes. By considering this fact, we arrived at the electromagnetic models of the photon and the electron which are shown in Figures 1, 2, and 3.[1,2,10,14]

The absence of orbital movement of the electron in the atoms leads to a serious reconsideration of the chemist's understanding of the roles of the valence electrons in the process of binding atoms in molecules. Because the electrons appear as almost spherical magnets with clearly distinct magnetic poles, and with almost uniformly distributed electric charges, they are oriented toward the nucleus with the opposite electrical charges, but this oncoming is limited by the same magnetic poles of the electron and the proton.

Two atoms can be bonded in a molecule by two means: 1) The electrical field of the electron of one atom interacts with the electric field of a proton of the other atom and they come closer; simultaneously, the magnetic poles limit this trend, and 2) The magnetic pole of one electron interacts with the opposite magnetic pole of an electron from the other atom and the electrical fields of the same charge limit this attraction. Starting from this, the bonds between the atoms in the molecules can be represented by lines linking their valence electrons one with the other or with the nuclei. Our studies[2] have shown that the Compton length of the wave of the electron, measured experimentally, is perfectly coincident with the

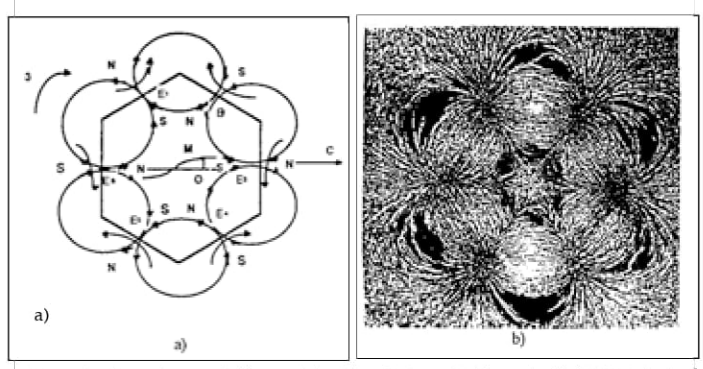

Figure 1. The scheme of the model of the photon. a) Theoretical b) Modeled

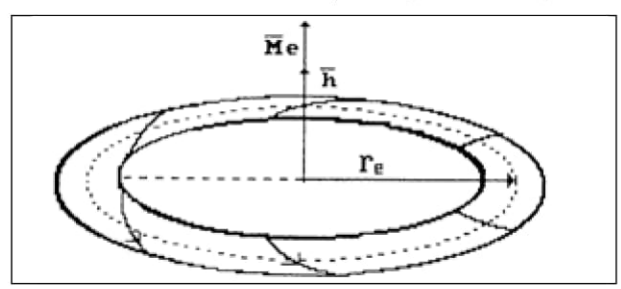

Figure 2. The model of the electron. Where M_e - is the magnetic moment of the electron; h - the Planck's constant; r_e the radius of the electron, equal to the length of its wave.

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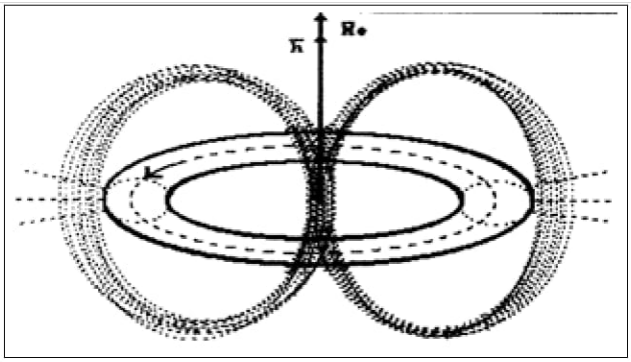

Figure 3. The scheme of the electrical and the magnetic fields of the electron.

value of the radius of the electron, calculated by us theoretically:

$$r_{theor} = 2.4263089 \bullet 10^{-12} m; \;\; \lambda_{\exp} = 2.4263089 \bullet 10^{-12} m \, .$$

Further, the significantly greater bonding energies of the seventh electron of the oxygen atom, at analogous energy levels, demonstrates the high strength of the bonds in the OH^- ions.

If we show all the magnetic force lines of the electron, these have a form of an apple, and the electric lines of force will be perpendicular on the surface of this apple.

Models of Atoms, Ions, and Molecules Participating in the Plasmaelectrolytic Process[2]

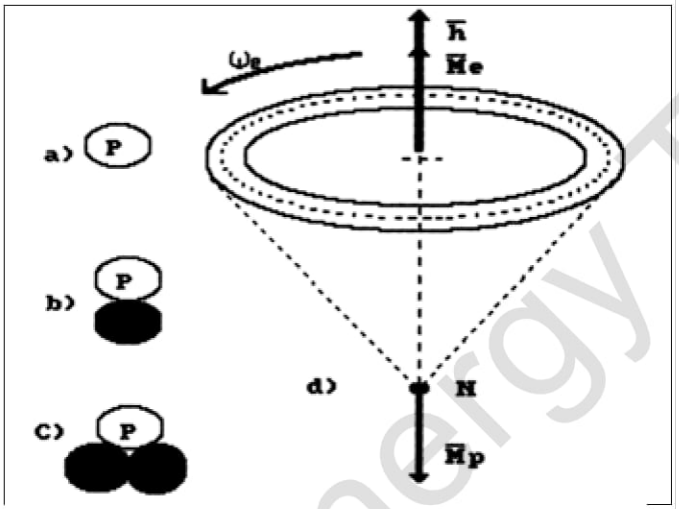

Figure 4. The models of the nuclei (a, b, c) and of the atom of hydrogen. Mp = the magnetic moment of the proton; N = the nucleus of the atom.

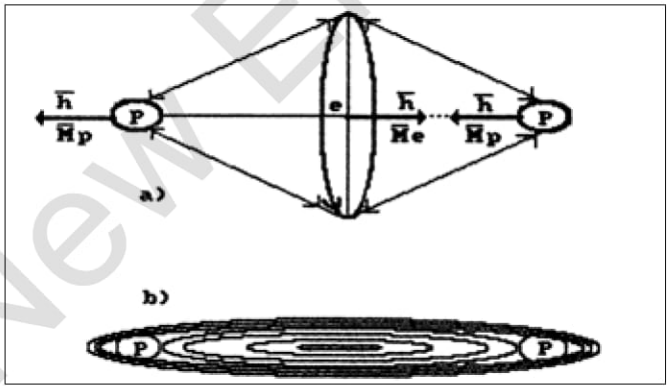

Figure 5. The scheme of the molecular ion of hydrogen a) resulting from the author's theory b) deduced from the Schrödinger equation , P = proton, e = electron.

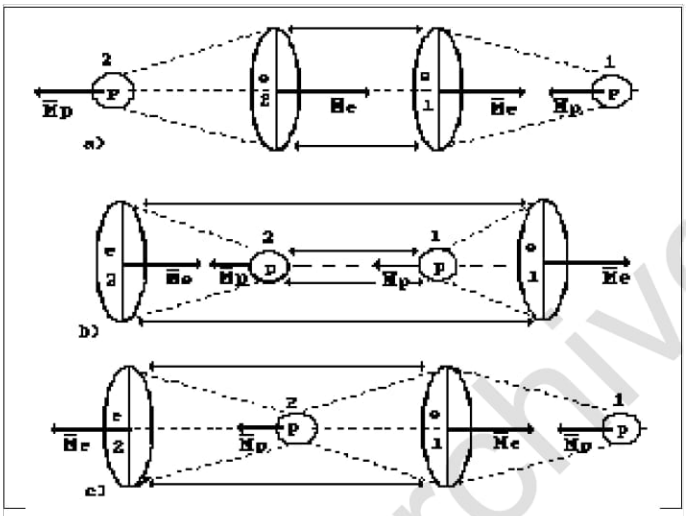

Figure 6. The schemes of the hydrogen molecules, a) and b) ortho-hydrogen, c) para-hydrogen

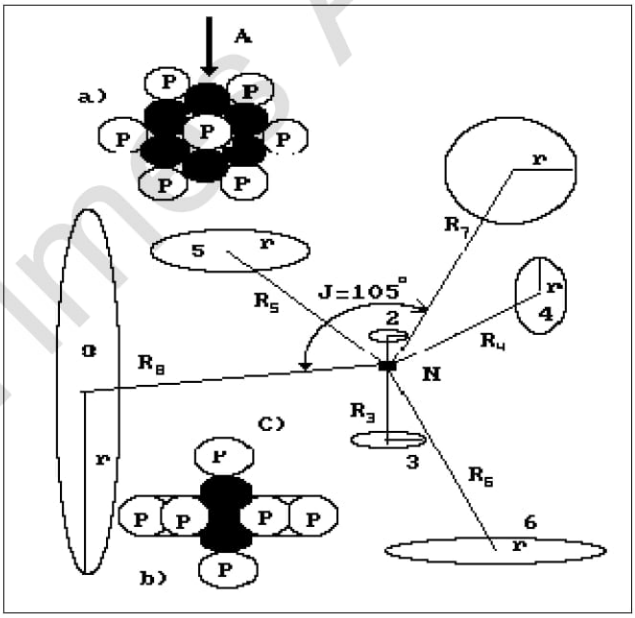

Figure 7. The model of the oxygen atom, a) O, b) the nucleus of the atom; c- the atom.

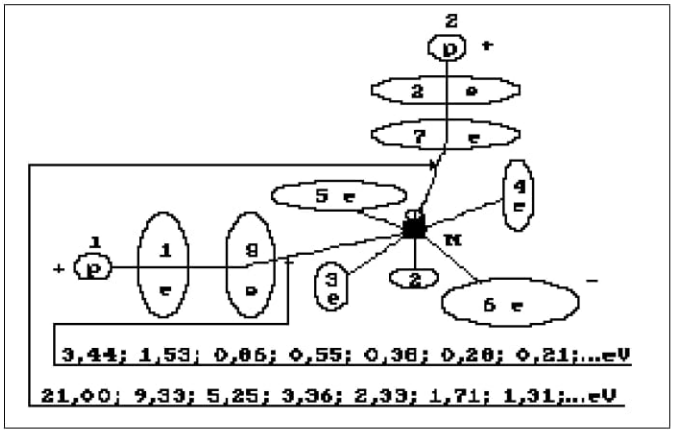

Figure 8. The first model of the water molecule H_2O with its energy bonds. P = the protons of the hydrogen atoms.

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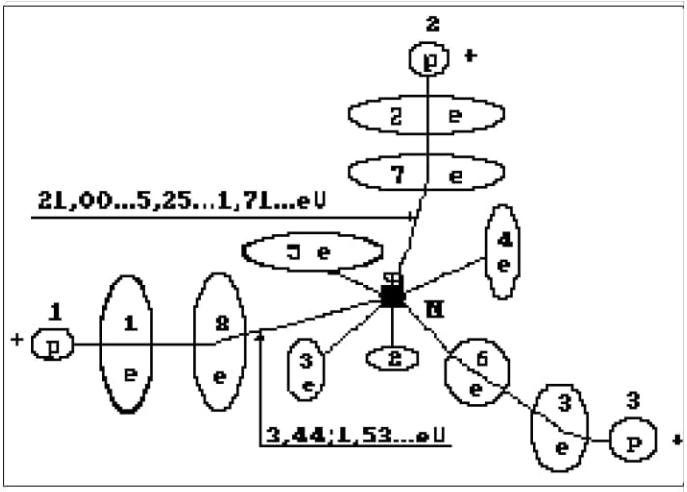

Figure 9. The model of the hydroxonium ion H_3O^+ with its energy bonds.

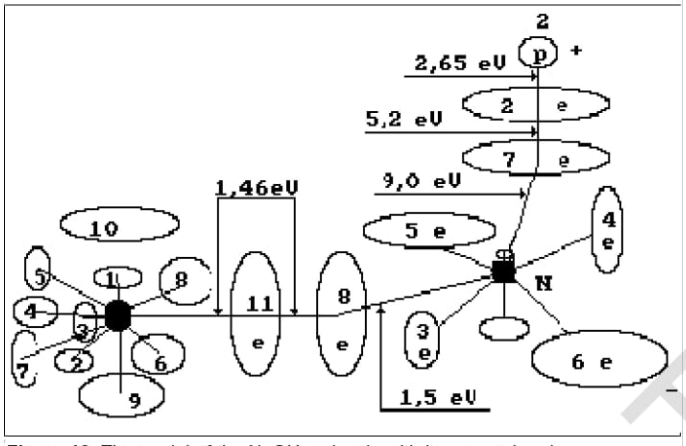

Figure 10. The model of the NaOH molecule with its energy bonds.

It is known that great hopes have been invested in hot nuclear fusion as a new source of energy. During forty years of research, more than $23 billion has been spent and there have been no positive results until now.[6]

The study of cold nuclear fusion has also generated great difficulties. The reason for the low reproducibility of the efficient results is not known even today.[6,12,14]

Less attention was drawn by the synthesis of atoms and molecules as a possible source of energy. Simple calculations show that if we successively synthesize the atoms and molecules of hydrogen and combine these with atoms of oxygen, we obtain one liter of water and a great quantity of energy is released, some five times more than at burning of one liter of gasoline.[2]

Suppose we now start to obtain the molecules of water from the present free protons, electrons, and molecules of oxygen. Let's calculate the quantity of energy released with the formation of one liter of water.

The process starts with the formation of the hydrogen atoms. The electrons, by bonding to the proton, tend to occupy the non-excited energy level and emit a totality of photons having an amount of energy equal to the ionization energy of the atom, *i.e.* 13.6 eV. For one mole of atomic hydrogen that gives 1312 kJ.

One liter of water contains 55.56 moles of H_2O molecules. For the simplicity of the calculus we will suppose that one liter of water contains 1,000 liters of molecular hydrogen. Then, by the decomposition of one liter of water we get 1999.9 liters (89.28 moles) of atomic hydrogen. By uniting this in molecules, 999.9 liters (44.64 moles) of molecular H_2 hydrogen are formed. Besides that, 245.5 liters (10.96 moles) of atomic oxygen, O are formed. By bonding in molecules this gives 122.7 liters (5.83 moles) of molecular oxygen, O_2. We are writing the chemical formulas of the shown processes with the corresponding energies released calculated for one liter water:

$$H^+ + e^- \rightarrow H + (1312 \bullet 89.28) = 117135.4 kJ/L \quad (7)$$

$$H + H \rightarrow H_2 + (436 \bullet 44.64) = 19463.0\ kJ/L \quad (8)$$

$$H_2 + 0.5O_2 \rightarrow H_2O + (285.8 \bullet 55.56) = 15879.09\ kJ/L \quad (9)$$

Adding the results, we obtain 152477.5 kJ/L. This is the potential energy which can be released at the described successive synthesis steps of one liter of water. If we take into consideration that the energy content of one liter of gasoline is about 30000 kJ, we can state that five times more is obtained via formation of the molecular bonds of water, starting with the birth of atomic hydrogen.

Obviously we have considered the most efficient variant of the process of the synthesis of one liter of water. In case that at the synthesis of the hydrogen atoms, the electron will occupy the second, excited energy level, the total energy for the synthesis of a liter of water will be less, 124,193.55 kJ; for the third level this quantity will decrease further.

We will illustrate now the achievement of this process in the Plasma electrolytic reactor, as given in Reference 2. After the filling of the interelectrode space with a diluted solution of alkali or acid, by increasing the voltage, the current varies as shown in Figure 1. First, at a linear increase of the voltage, the current is also increasing according to Ohm's Law. Later at about 40 Volts, Ohm's Law is not more valid, while around 100 V (points 5-6) the current decreases abruptly and at the cathode a bright light appears (plasma).

By the following forced decrease of the voltage, the current is not changed much and is rather low. The color of the plasma is changed from bright red to rose, yellow, blue, violet and invisible UV. By spectral analysis of the color-changing plasma it has been shown that it generates atomic hydrogen.

At a voltage near to 60 V (points 14-15) the glow of the cathode ceases and the current increases suddenly to a value near to the previous ones. By analyzing the data of Table 5 and Figure 11, we can formulate the following physical model of the process. Up to a voltage of 60 V, in the solution the well-known ionic conductivity is at work. At these potentials, some protons are separated from the hydroxonium ions, H_3O^+ and from the molecules of water H_2O and are directed to the cathode. But this process is unstable, the majority are bonded again to other ions.

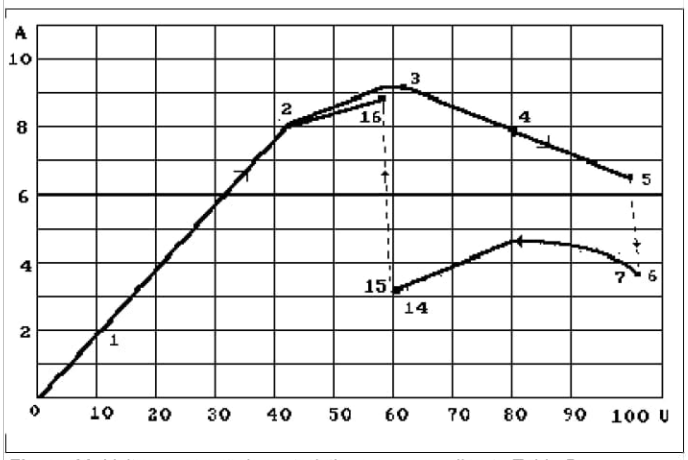

Figure 11. Voltage-current characteristics, corresponding to Table 5.

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Table 5. Data obtained with a plasmaelectrolytic reactor at a flow of solution of HCl 8.74 liters/hour and inlet temperature 23.0 °C.

Numb. of the point	Voltage, V	Current, A	Inlet energy, kJ	Water temper. at outlet, °C	Energy used for heating the water, kJ	Outlet energy, kJ	Energy differ-ence, kJ	Coefficient of perfor-mance, %
1	2	3	4	5	6	7	8	9
1	10	1.7	61.2	24	36.6	36.6	-24.6	59.8
2	40	8.2	1180.8	49	952.1	952.1	-226.7	80.6
3	58.5	9.15	1927.0	73	1831.0	1831.0	-96.0	95.0
4	80	7.85	2260.8	82	2160.6	2160.6	-100.2	95.6
5	100	6.65	2394.0	83.5	2215.5	2215.5	-178.4	93.0
6	85	4.7	1438.2	69	1684.5	1684.5	+246.3	117.1
7	76	4.3	1176.5	65	1538.0	1538.0	+361.6	130.7
8	68.5	3.75	924.7	55	1171.8	1171.8	+247.2	126.7
9	88	4.5	1425.6	71	1757.8	1757.8	+332.2	123.3
10	92	4.2	1391.0	71	1757.8	1757.8	+366.8	126.4
11	94	4.4	1489.0	71.5	1776.1	1776.1	+287.1	119.3
12	98	4.2	1481.8	71	1757.8	1757.8	+276.0	118.6
13	68	3.9	954.7	56	1208.5	1208.5	+253.8	126.6
14	64	3.3	760.3	50	988.7	988.7	+228.4	130.0
15	61	3.05	669.8	46	842.3	842.3	+172.5	126.0
16	57.5	9.3	1925.1	72	1794.4	1794.4	-130.7	93.2

Table 6. Data obtained with a plasmaelectrolytic reactor at a flow of solution of H_2SO_4 8.74 liters/hour and inlet temperature 23.0 °C.

Numb. of the point	Voltage, V	Current, A	Inlet energy, kJ	Water temper. at outlet, °C	Energy used for heating the water, kJ	Outlet energy, kJ	Energy difference, kJ	Coeffic. of perfor-mance, %
1	2	3	4	5	6	7	8	9
1	20	5.1	367.2	39.5	274.0	274.0	-93.2	75.0
2	40	7.8	1123.2	63	1132.4	1132.4	+8.6	101.0
3	57	8.5	1744.2	82	1826.5	1826.5	+82.3	105.0
4	80	7.25	2088.0	84	1899.6	1899.6	-188.4	91.1
5	95	4.0	1368.0	80	1753.4	1753.4	+385.4	128.2
6	85	4.1	1254.6	78	1680.4	1680.4	+425.8	134.0
7	72	3.0	777.6	71.5	1443.0	1443.0	+665.4	185.6
8	61	3.5	768.6	63	1132.4	1132.4	+363.8	147.3
9	57	3.4	697.7	61	1059.4	1059.4	+361.7	152.0
10	54	9.2	1788.5	82	1826.5	1826.5	+38.0	102.1
11	40	7.8	1123.2	62.5	1114.2	1114.2	-9.0	99.2

Remark: the energy corresponding to the released hydrogen and oxygen, as well as the radiation energy of the light is not used in the energy balance.

As the voltage further increases, the kinetic energy of the protons separated from H_3O^+ and H_2O, as well as the kinetic energy of the alkaline ions is sufficient to extract the protons from similar molecules on their way to the cathode. If the flux of protons is focused toward the cathode, the intensity of the chain reaction of the formation of free ions also increases.

By encountering the electrons of the cathode, the protons are forming hydrogen atoms. The electrons are emitting energy as photons. The red color of the plasma in the very first stage of formation (points 5 and 6) shows that the hydrogen atoms are in an excited state at the superior levels of energy, generating the red Balmer lines of the spectra.

It has to be emphasized that these are thermal photons. They are absorbed by the water and intensely heat it, as demonstrated by the experiment (Table 5).

As the voltage is further increased (points 7-14) the volume of the plasma decreases, the energy levels of the electrons of the hydrogen atoms go toward the proton, the energy of the emitted photons increases, the wavelength decreases, and the color of the plasma changes from red to ultraviolet. Eventually, there comes a moment (point 15) when the potential of the electrodes is not more sufficient for the extraction of the protons from the molecules of water and the process is interrupted and the system returns to the initial state of ionic conductivity (Figure 11).

The variation of the temperature of the water (Table 5), which is synchronized with the color change of the plasma, is due to the change of the quantity of the emitted thermal photons in the system. We call "thermal" the photons having energies in the red and infrared domains of the spectra (the red color of the plasma). They appear from the transitions of electrons on energy levels most remote from the nuclei.

By analyzing the data of Table 1 and Figure 1, the most interesting proved to be those for point 6. This regime appears automatically. For point 5 there is no stable plasma, only blinking can be noticed. Then, after a while, quite automatically, the current decreases and the voltage increases a bit; the temperature of the solution decreases slightly.

The most important remark is that excess of the protons at the cathode is not formed due to the increase of the voltage (in this case the inlet power had to increase proportionally), but on the basis of the use of the kinetic energy of the primary protons released from the bonds and by the chain reaction of getting free protons from the molecules H_2O and ions H_3O^+. Just for this reason, the increase of the quantity of free protons is not associated with an increased consumption of energy for their formation. Here is hidden the main source of excess energy.

At protonic conductivity, the molecules of water are destroyed mainly at the expense of the kinetic energy of the avalanche-type movement of the protons and alkaline ions toward the cathode, and not on the basis of the direct destruction of the bonds directly due to the applied voltage.

The second source of excess energy is the work of the electron in the atom, as described in Reference 2. The electron has a form of an empty torus, having two rotation movements: the first relative to the central axis of symmetry and the second relative to the round axis going through the center of the section of the torus. Due to the nature of these rotations, the electromagnetic structure of the electron is in a stable state only for a strict ratio between these rotations and for a determined, strictly constant mass of the electron. The change of this mass (the density of the electromagnetic field) rapidly destroys the stability of the structure of the electron if it is in a free state. In order to avoid the destruction of the equilibrium, the electron readily absorbs photons with the necessary mass (energy) from the surrounding medium. If there are no such photons in its vicinity, then they are formed in the surrounding aether, that's physical vacuum and so the state of the electron is preserved.

When the electron is linked to a nucleus of an atom, it radiates a part of its energy in the form of a photon. This is the excess energy. If the bond to the nucleus is broken, then because it is again free, the electron again absorbs a photon which warrants its stability. After regaining its mass (energy) to a stable state, it can be again linked to a nucleus, emitting a photon corresponding to the energy of its bond to the atom and so on. Thus there are circumstances in which the electron absorbs energy in the

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form of electromagnetic substance (which can be identified with what is called "aether"), from the medium and gives it to the atoms and the molecules. So excess energy appears too. However, this is a simplified description of the facts.

If now there is consumption of mechanical or sonic energy by which we can interact with the molecules of water, and if we know the energy levels of the valence electrons in the molecules as well as the energies of their bonds to the nuclei of the atoms and of the bonds between them (Tables 1-4), we can calculate the values of the energy to be taken by the electrons from the surroundings after the mechanical breaking of the bonds of the atoms or molecules. These are the two hypotheses which explain the sources of excess energy on the basis of our theory.[14]

It is known that atomic hydrogen does exist at temperatures of 5,000-10,000 °C. This means that in the zone of atomic hydrogen, plasma with such temperatures has to be formed. Obviously, this plasma can be maintained only at a sufficient density of the hydrogen atoms in the given volume. In order to meet this requirement the flux of protons has to be focused on the cathode.

What processes take place at the interface of the plasma and solution? Because around the plasma there is water, the plasma will be cooled down and the following reactions will take place:

$$H^+ + e^- \rightarrow H + 1312\ kJ/mol. \qquad (10)$$

$$H + H \rightarrow H_2 + 436\ kJ/mol. \qquad (11)$$

$$H + OH^+ \rightarrow H_2O + 502\ kJ/mol. \qquad (12)$$

Remark : for the reactions (7) to (15) we take the released energy with the sign + (plus), meaning an increase of the energy of the system. Usually, in the contemporary chemical literature for exothermic reactions the released energy is taken as - (minus) and for the endothermic reaction as + (plus). We are using the opposite, more logical, signs.

If both protons of the hydrogen atoms are extracted from the molecule of water (Figure 8), the oxygen atom, having two excess electrons, goes to the anode and is released in atomic or molecular form. If an O_2 molecule is formed, the following quantity of energy is released:

$$O^- + O^- = O_2\ 143 kJ/mol \qquad (13)$$

The following reactions also can take place at the anode:

$$H_2 + 0.5O_2 \rightarrow H_2O + 285 kJ/mol \qquad (14)$$

$$H + O \rightarrow OH + 424 kJ/mol \qquad (15)$$

If we exclude the endothermic reactions, and this possibility really exists, the global energy released will be:

$$1312 + 436 + 502 + 143 + 424 + 285.5 = 3102.8\ kJ \qquad (16)$$

This quantity of energy, initiated by one mol of atomic hydrogen, is almost ten times greater than the energy necessary for heating one liter water from 20 °C to 100 °C, and it is also greater than the energy necessary for evaporating one liter of water. Thus, by the process described, the water had to be evaporated instantaneously. However, for the reactor models giving the results from Table 5, this does not happen, because in parallel to these exothermic reactions, other endothermic reactions take place.

1- formation of hydrogen peroxide H_2O_2

$$H_2O + O \rightarrow H_2O_2 - 109 kJ/mol \qquad (17)$$

2- formation of ozone, O_3

$$3O_2 \rightarrow O_3 - 284 kJ/mol \qquad (18)$$

3- formation of the hydroxonium ion H_3O^+

$$H_2O + H \rightarrow H_3O^+ - 320 kJ/mol \qquad (19)$$

If the reactions (10) to (19) have different probabilities, the differences between them give the excess energy. Unfortunately, both the rates of the exothermic (10-16) and of the endothermic reactions (17-19) are not known precisely. The change of the solution temperatures (Table 5) suggest that in the zone of intense formation of protons (points 3, 4, 5) the intensity of exothermic reactions is lower than for points 7-15, where the plasma is maintained, and the temperature is decreased.

The decrease of temperature of water at the stage of decrease of voltage for the experiment (Table 5, points 6-15) can be explained by the intense heat absorption due to the formation of hydrogen peroxide H_2O_2 , ozone O_3, and ion H_3O^+ as well as due to the diminishing of the quantity of thermal photons.

Thus, a primary analysis of the phenomena taking place in the plasma electrolytic reactor, suggests the possibility of obtaining excess heat, and this is supported by the experiment.[13, 14]

More detailed information about the problems discussed here can be found in the book *Water as a New Source of Energy*, which is in the process of being published in Russian.

Power efficiency parameters for the plasma-electrolysis, experiment with the reactor No 3.

As shown by theoretical calculations, during the formation of a hydrogen atom from a proton and an electron, the latter will be placed on the second energy level, the ensuing process of synthesis of water will give 75,465.76 kJ of energy; in case of the electron going to the third level, the corresponding value will be 55,562.4 kJ.

In order to determine the global efficiency parameter of the process, we have to know the energy spent for the decomposition of the molecules of one liter of water via the plasma-electrolysis method. We have to admit that this value is not known yet and therefore we will consider here the value of energy spent for decomposing one liter of water in its gaseous constituents, hydrogen and oxygen, by the best modern electrolytic technologies.[3,4,7,14]

One liter of water contains 1,222.2 liters of hydrogen, while the energy consumed for producing 1000 liters of water via the best electrolysis methods is 4 kWh. Therefore, the production of hydrogen from one liter of water will need 1,222.2/1000x 4= 4.9 kW, or 4.9 x 3600=17,640.0 kJ. This value will be taken into account for the calculation of the global efficiency parameter of the plasma-electrolysis process. The greatest value of this parameter will be obtained for the case of the electron placed at the second energy level, K_1= 75,465.76/17,640=4.28.[14] When the electron is placed on the third energy level, the value of the global efficiency parameter will be smaller, K_2=55,561.4/17,460=3.15. For a careful measurement of all the energy components of a plasma-electrolysis experiment, values in the interval 3.15...4.28 have to be obtained. This result is predicted by the theory. And what does the experiment yield?

During the following experiment, the reactor No. 3 was adjusted for the gas-steam mode of operation and a heat exchanger was used for the condensation of steam. The flow of gases after condensation of steam was measured using an anemometer. We have measured the energy taken by the cooling liquid and the consumption of electric energy (the number of rotations of wattmeter).[14]

Note: the hydrogen obtained after the condensation of the steam can contain other gaseous impurities such as oxygen and ozone, possibly also helium (if cold fusion takes place), however, the author had no possibility of performing such an analysis; therefore the average value of energy in hydrogen is the subject of further clarification. The following factors are not considered

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Experimental Results

Parameters	1	2	3	Average
1) Duration of experiment $\Delta\tau$, seconds	300	300	300	300
2) Weight of cooling water m, grams	8600	9250	8750	8867
3) Temperature of water, at the inlet of cooler, t_1 °C	24	24	24	24
4) Temperature of water, at the outlet of cooler t_2 °C	29.0	28.5	29.5	29.0
5) Temperature difference cooling water $\Delta t = t_2 - t_1$ °C	5.0	4.5	5.5	5.0
6) Flow of gases (hydrogen) as indicated by the anemometer W, liters	19.2	20.7	25.5	21.8
7) Number of rotations of the wattmeter disk n	23.5	24.0	29.0	25.5
8) Consumption of electrical energy based on the counter E_1, kJ $E_1 = \frac{n \bullet 3600}{600}$.	141.0	144.0	174.0	153.0
9) Voltage, V	220.0	220.0	220.0	220.0
10) Current I, Amperes	1.66	1.75	1.89	1.77
11) Consumption of electrical energy based on the volt- and ampermeter, E_2, kJ $E_2 = I \bullet V \bullet \Delta\tau$	110.0	115.5	124.7	116.7
12) Energy consumed for heating the water, E_3, kJ $E_3 = C \bullet m \bullet \Delta\tau$ 4,18.	179.7	174.0	201.2	185.0
13) Energy content in hydrogen E_4, kJ $E_4 = W \bullet 0.09 \bullet 142$.	245.7	264.1	326.6	278.8
14) Total energy for heating and hydrogen's energy, E_o, kJ $E_0 = E_3 + E_4$, kJ	425.4	438.1	527.8	463.8
15) COP of the reactor, according to wattmeter readings $K_1 = \frac{E_0}{E_1}$	3.1	3.2	3.0	3.1
16) COP of the reactor according to the voltmeter and the ampermeter readings $K_2 = \frac{E_0}{E_2}$	3.8	4.0	4.2	4.0
17) Consumption of electric power for the manufacture of one cubic meter of hydrogen, kWh/m^3 (according to the wattmeter readings)	2.0	1.9	1.9	1.9

here: the energy of oxygen formed in the anodic compartment, the heat losses (the heat exchanger is not insulated) and the energy of the light radiated. The other kinds of energy (noise, high frequency electrical oscillations) can be neglected.

Thus the values of the global efficiency parameter are placed within the values predicted theoretically. It is important to show that the consumption of energy for manufacture of one cubic meter of hydrogen decreased by a factor of two compared to the present technological values.

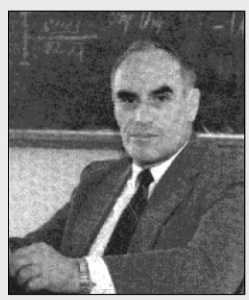
Acknowledgment

The author is indebted to his colleague, E.D. Zykov, for strong collaboration in this experimental work. The results presented in Tables 5 and 6 had been obtained by us with the financial support of V. V. Podobedov. The novelty of our results is attested by a patent application with priority date November 15, 1997. *Infinite Energy* is indebted to Peter Glück for his help in the translation of this paper.

References

1. Ph.M. Kanarev, "The Laws of Formation of Spectra of the Atoms and Ions," *The Problems of Space, Time, Gravity*. Collection of scientific papers of the Fourth International Conference, St. Petersburg, September 16-21, 1996, p. 30-37 (in Russian).
2. Ph.M. Kanarev, *The Crisis of Theoretical Physics*, 3rd edition, Krasnodar, 200 pages (in Russian).
3. A.B. Golstein and F.E. Serebrianskii, "The Use of Electrolysis Plants for the Production of Hydrogen and Oxygen," *Energiia*, 1969 (in Russian).
4. S.E. Nilsen and Knut Andreaseen, "Hydrogen Production Using Electrolysis," *IFORM: Int. New Facts, Oils and Relat. Mater.*, 1996, No. 10, p. 1120-1123.
5. J. Patterson, U.S. Patent 5,632,871, 1997.
6. Harold L. Fox, "Nuclear Cold Fusion: Essence, Problems, Its Impact on the World," Production group SVITEKS, Moscow, 1993, 183 pages (in Russian).
7. A.I. Mishenko, *The Use of Hydrogen as Automotive Fuel*, Kiev, Naukova Dumka, 1984 (in Russian).
8. Cold Nuclear Fusion. *Proceedings of the Third Russian Conference on Nuclear Cold Fusion and Transmutations of Nuclei*, Dagomys, 1995, 321 pages (in Russian).
9. Cold Nuclear Fusion. *Proceedings of the Fifth Russian Conference on Nuclear Cold Fusion and Transmutations of Nuclei*, Dagomys, Sochi, 28.09-04.10.1997, 360 pages (in Russian).
10. Ph. M. Kanarev, *On the Way to the Physics of the 21st Century*, Krasnodar 1995, 267 pages, in English.
11. T. Ohmori and T. Mizuno, "Excess Energy Evolution, New Element Production, and Electromagnetic Wave and/or Neutron Emission in Light Water Electrolysis with a Tungsten Cathode," *Infinite Energy*, Vol. 4, Issue 22, 1998, pg 14-17.
12. "Protocol of Control Testing of the Plasmaelectrolytic Reactor No. 3," Krasnodar, May 22, 1998 published in *Infinite Energy*, Vol. 4, Issue 23, pg. 31-32.
13. Tewari Paramahamsa, "Violation of Law of Conservation of Charge in Space Power Generation Phenomenon," *The Journal of Borderland Research*, Vol. XLV, No. 5, September-October 1989.
14. Ph.M. Kanarev, *Water as a New Source of Energy*, Krasnodar, 1999 (in Russian).

About the Author



Phylipp Michailovich Kanarev was born near Maikopskii, Krasnodar, Russia in 1936. He became a faculty member at Leningrad State University and then the Kuban Agricultural Institute. He earned his master's in 1967 and his doctorate (summa cum laude) in 1974. He received a Doctorate of Engineering Science in 1976 and became a professor at The State Agrarian University of Kuban, at which he became head of the theoretical mechanics department in 1982. Prof. Kanarev had investigated open-mindedly the very basics of quantum mechanics and theory of relativity and had concluded that the internal contradictions of these fields, as well as their inability to explain some experimental data, are caused by the absence of the fundamental axiom of unity of space-time-matter from these conceptual constructs. By solving this problem, Dr. Kanarev has gained a new insight in the deep structure of the microworld.

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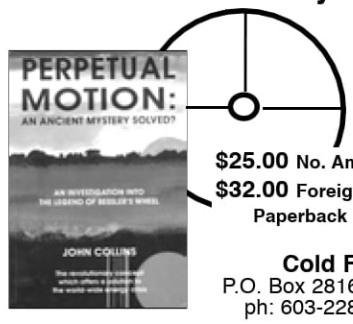

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Gravity continued from page 26

the foremost German expert on gravitation (See *IE* No. 22, p. 57-59). Then the friendly, white-haired Zinsser began to describe his ten years of research to us as I reached for my tape recorder. There was an excitement in the air as Adam and I struggled to comprehend Mr. Zinsser's patented pulse generator (U.S. #4,085,384) causing an unprecedented 3 to 5 hour force from a brief "activation" of only 90 seconds. We were shown a 6-inch plexiglas cylinder with two aluminum plates inside submerged in a water dielectric. He described the small activator in front of us energizing an object suspended in a vacuum.

Mr. Zinsser showed us graphs recording the angle of deflection of the object which was labeled in terms of force. A maximum of 8 dynes manifested within 1/4 hour of activation, slowly dropping to zero about 5 hours later. He said everything could be scaled upwards without difficulty. In comparing the impulse delivered to power input, he said it was at least 10,000 times the ratio obtained from chemical rockets (based on Dr. Peschka's analysis).[2] I am really glad I met Rudolph Zinsser, who certainly destroyed my conventional notions of force and energy.[3]

That night I briefly shook hands with John Searl in the restaurant when he arrived. However, I learned the next day that he was sent back to England by Dr. Nieper to maintain "a certain credibility level." It seems that Mr. Searl had no demonstration model (which no one else had) and no concise speech prepared. John Searl is known for his various high voltage, anti-gravity saucers he has built over the years.[4]

Nieper N-Machine: The conference began the next day with Dr. Nieper giving a long slide presentation on his shielding theory of gravity. About 300 people were there from as far away as New Zealand for this event. He showed a few slides of the N-machine he had built based on photos sent by Bruce DePalma. (Unfortunately, Bruce was advised not to go since he had no patent application filed.) Because of brush friction, the motor-generator combination was not self-sustaining. (See *IE* No. 15/16 pg. 84 for DePalma obit.)

Kirchhoff Talk: Next came Mr. Kirchhoff, a diplomat from E. Germany, speaking on the Collision which is Programmed by Inertia of Natural Science vs. Crisis of Lack of Energy. A slide of Dr. Peshka's article about Mr. Zinsser's work was included. (Note: this article has just been published in English for the first time in *Infinite Energy*, Issue 22, 1998, p. 52, with commentary by translator Don Reed.)

Zinsser Lecture: The third speaker was Rudolph Zinsser. The talks so far had been given in German with Dr. Nieper translating sporadically but this time Mr. Zinsser did both. He explained his kinetobaric effect by the "chaos" that is created in the center of mass by the trigger energy. He repeated the description of random (about 1 mm) oscillations that continue for years afterwards—a side effect he says he has now eliminated.

Dr. Seike's Presentation: Dr. Seike was next with many slides, most of which were from his book, *The Principles of Ultra Relativity*.[5] He started with a description of the Mobius strip and resultant "double solenoid." He proceeded into the three phase oscillator which increases frequency in about three days. Seike included the theory of his harnessing tachyon or "imaginary mass current" for his devices. Next he showed the oscillator from p. 291 of his book and emphasized the barium titanate used. (It was also three phase.) The energy density of the G-field was noted as he presented the possibility of a "G Power Generator." This turned out to be an electrical generator (p. 265) which increases from 2 to 40 volts in three months absorbing "g-energy."

Stone Melted: The last amazing topic was Dr. Seike's circuit for melting a stone (p. 251). Even though there is a 400 V, 300 mA source added, the slide of the melted stone was very impressive (p. 273). He was right when he mentioned that this is not possible even with a comparable welder's gun. At first I thought the power source invalidated his claim.

He also mentioned that the stone will totally disappear if the "flare" is sustained. Apparently the circuit generates a visible tachyon-electric arc, usually only possible with voltages 10 to 100 times higher.

Dr. Seike noted that G-power comes from a negative energy state and uses p-type semi-conductor material. He promises to talk about imaginary acceleration by tachyon propulsion at the next meeting!

Stelle and Trombly N-Machine: Mr. Kinnegar from Dallas was next, talking about the Stelle Group's N-machine, which also was a Faraday motor and generator combination. He had many detailed slides. They also had brush friction problems and plan to use mercury next.

Adam Trombly, director of Acme Energy Research in San Rafael, talked about his "state of the art" NaK liquid brush N-machine which should be completed soon. His design eliminates that major obstacle of brush friction which has plagued other models.

Valone Presentation: Then I talked briefly about Bruce DePalma's Sunburst generator, the highest power (8 kW) N-generator yet built. I had a few transparencies, including one of the Santa Barbara News-Press (3-30-80) article of Bruce with his picture. I felt that at least they could see what he looked like since he was mentioned so much! I also outlined my M.A. project which involves testing the back torque of an N-generator. (Note: a full report of the Stelle machine and the Valone generator is contained in *The Homopolar Handbook*, 2nd edition, see ad on page 26).

Borge Frokjaer-Jenson: Lastly, the mysterious Borge Frokjaer-Jenson spoke a few words.[6] He said that he was associated with groups in Denmark and Sweden and had tested the DePalma machine. They have also discovered a transformer that puts out three times the input power (*e.g.* 3 watts for 1 watt in). When I met him personally, he would not volunteer more information. I have since wondered if it is related to the Alexander patent (#3,913,004) that has the same claim.

The Day After: That was the major part of the conference. The next day Dr. Nieper met with the speakers and some other invited people in hopes of coming to some international agreement about energy inventors and their support. The date for the American conference was set. The night after the conference, all of the speakers were received at Dr. and Mrs. Nieper's house for a cordial get-together.

It was exciting meeting poorly funded experimenters from European countries, as well as successful inventors looking for more ideas at the conference. By the way, the overwhelming and beautiful book, *UFO. . .Contact from the Pleiades*,[7] talks about tachyon propulsion for the Pleiades crafts and describes effects similar to Searl's saucers.

Germany is a friendly place and has high quality in most of its products. On the way to the airport coming home, I met a taxi driver who had been a POW in World War II and was sent to Texas for a year. In the airport, I saw Dr. Seike again and he asked me if I knew anything about UFOs. He admitted receiving help from his UFO contacts. It's about time we received some help, isn't it?

Proceedings and Next Conference: George Hathaway, a consultant in Ontario, may be the organizer of the next conference. He has just compiled the text of the conference for distribution.[8] The Mittelstands-Institut in Hannover should have the proceedings available presently.[9] Thank goodness for Dr. Hans Nieper."

References

1. *Let's Live*, June 1980, p.144
2. W. Peshka, *Raumfahrt Forshung*, Feb. 1974
3. Rudolph Zinsser, Junkerrech 34/ Weierbach, D-6580 Idar-Oberstein, W. Germany
4. Updated reference: John Searl can be contacted through U.S. representative, John Thomas, 716-467-2694, who is also the author of *Anti-gravity: The Dream Made Reality*, the Story of John R. R. Searl
5. Seike, *Ultra Relativity*, G Research Lab, 2-1, Ohmihachoh 1, Uwajima City, Ehime (798), Japan.
6. Borge Frokjaer-Jenson, Prins Valkemars Vej 34, DK-2820, Gentofte, Denmark.
7. *UFO, Contact from the Pleides*, Genesis III Publishing, PO Box 32067, Phoenix, AZ 85064
8. George Hathaway, Hathaway Consulting Services, 39 Kendal Ave., Toronto, Ontario M5R1L5.
9. Mittelstand-Institut, Augustinerweg 20, 3000 Hannover 21, W. Germany.

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Physical Laws of the Emerging New Energies as Predicted by Hadronic Mechanics, IIB: The New Mechanics*

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This series of articles is further evidence of the current leading role by corporations in the support of truly innovative research which has become impossible in the contemporary academic-governmental community. —R. M. Santilli

Editor's Note: This difficult theory article by Dr. Santilli continues the series that began in Issue No. 22 with "Part I: Insufficiencies of Quantum Mechanics" and continued in Issue No. 23 with an introduction for this paper, "Part II: The New Mechanics."

For those many non-mathematical and non-physics theory-oriented readers for whom this material is relatively impenetrable (or in many cases *completely* impenetrable), we ask for your understanding and patience. It is extremely important to have a place in *Infinite Energy* in which a well thought out pioneering theory that transcends conventional quantum mechanics is presented and discussed, in the context of its possible applications to a large variety of new energy phenomena and technologies. This can be the basis for those key theory experts within our readership to examine Dr. Santilli's theories and formalisms to compare them with their own understandings.

As Dr. Santilli stated in his first article, "A form of energy is said to be 'new' if and only if it is not predicted and quantitatively treatable via quantum mechanics, chemistry, superconductivity, or other established disciplines." Many if not most theorists in the cold fusion field believe that standard quantum mechanics will be able to deal with cold fusion phenomena. Physicists and theorists such as Drs. Scott and Talbott Chubb or MIT Professors Peter Hagelstein and Keith Johnson have made apparently excellent progress in their theoretical work to describe cold fusion phenomena. But there is no certainty that their models can encompass *all* of the host of exotic phenomena that this field has revealed in solid state systems. Perhaps Dr. Santilli's formalisms can, or maybe they will take up his challenge to go further with a competing theory.

We realize that Dr. Santilli is being extremely ambitious. He insists, for example, that there are regimes for which Special Relativity theory has no basis, *e.g.* within the substance of massive particles, hadrons. (Other heretics, of course, reject Special Relatively even as it pertains to *in vacuo* situations.) He also points out that standard quantum mechanics is unable "to reach an exact representation of total nuclear magnetic moments beginning with that of the deuteron. . ." Dr. Santilli suggests that his *covering* theory—one that is larger than quantum mechanics—can do so. This generalization of quantum mechanics he calls *hadronic mechanics* and he has been perfecting it since 1978. Needless to say, his serious challenge to established physical theory has neither been treated kindly nor has even received much attention from the mainstream.

Any theoretical developments pertaining to misunderstanding of the deuteron (the nucleus of heavy hydrogen) should certainly prompt interest within the cold fusion community, because in deuteron interactions within the palladium crystal lattice is where this whole field began. Dr. Santilli's formalisms extend far beyond these initial cold fusion discoveries, however, even into the realm of cosmology, as this issue's treatment suggests. It is in the area of new nuclear energies and new forms of molecular bonding and energy releases on which his future papers in this series will dwell. He has told us that he will provide data from new experiments in exotic gases and the like which support his theories.—*EFM*

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3. THE "MAJESTIC" AXIOMATIC CONSISTENCY OF QUANTUM MECHANICS

It is important in these papers to separate the limitations of quantum mechanics from its axiomatic consistency. In fact, the latter is simply "majestic" (as stated in Paper I) and, therefore, the numerical predictions of the theory, when applicable, are unquestionable. The limitations are due to the fact that the basic axioms of quantum mechanics in their current realization are not valid for the entire universe, but are solely valid for conditions under which particles can be effectively approximated as being point-like.

The "majestic" axiomatic consistency of quantum mechanics is due to the fact that its finite time evolution characterizes a *Lie group of unitary transforms* on a Hilbert space $\mathcal{H}$ with states $|\psi>$ over a field $C(c,+,\times)$ of complex numbers c with conventional addition + and multiplication × (the literature on quantum mechanics is so vast as to prevent discriminatory partial listings),

$$A(t) = U(t) \times A(0) \times U\dagger(0) = e^{iH\times t} \times A(0) \times e^{-it\times H},$$
$$|\psi(t)> \; = \; U \times |\psi(t_0)> \; = \; e^{iH\times t} \times |\psi(t_0)>,$$
$$U \times U\dagger \; = \; U\dagger \times U \; = \; I, \qquad (3.1)$$

with corresponding infinitesimal version given by the celebrated Heisenberg's and Schrödinger equations

$$i\, dA / dt \; = \; [A, H] \; = A \times H \; - \; H \times A,$$
$$[r^i, p_j] \times |\psi> \; = \; \delta^i_j \times |\psi>,$$
$$H \times |\psi> \; = \; E \times |\psi>, \quad H = H^\dagger, \quad E \in R(n,+,\times),$$
$$p_k \times |\psi> \; = \; -\hbar\, \partial_k |\psi>, \qquad (3.2)$$

where: H (= $H^\dagger$) is the (Hermitean, thus observable) Hamiltonian representing the total energy); $R(n,+,\times)$ is the conventional field of real numbers n; and the product $[A, B] = A\times B - B\times A$ characterizes a Lie algebra.

The "majestic" axiomatic consistency of quantum mechanics indicated in Section I-2.2 is then guaranteed by its Lie structure, which assures the invariance of the entire theory under unitary transforms. This includes the preservation under the time evolution of the physical laws and numerical predictions, as illustrated by the following basic invariances under unitary transforms:

$$U\times H\times|\psi> = U\times H\times U\dagger\times U\times|\psi> = H'\times|\psi'> = E'\times|\psi>, \; E' = E,$$
$$U\times(e^{iH\times t})\times U^\dagger = U\times(I + iH\times t/1! + (iH\times t)2/2! + \ldots)\times U^\dagger = e^{iH'\times t},$$
$$U \times (A \times B) \times U^\dagger \; = \; A' \times B', \quad K' = U\times K\times U^\dagger, \quad K = A, B$$
$$U\times[A, B]\times U^\dagger = A' \times B' \; - \; B' \times A',$$
$$U\times[r^i, p_j]\times|\psi> = [r'^i, p'_j]\times|\psi'> = \delta^i_j\times|\psi'>. \qquad (3.3)$$

It then follows that unitary transforms leave invariant all various special functions and transforms, thus preserving the data elaborations of the theory. This axiomatic consistency then results in *invariant basic units of space, time, energy, etc., as well as unique and invariant numerical predictions.* The same occurs for

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all basic spacetime symmetries of the theory, such as the celebrated Galilei's and Poincaré's symmetries. Whenever *physically* applicable, quantum mechanics then yields consistent results without internal inconsistencies.

The main line of research followed in these papers is that of assuming the axiomatic consistency of quantum mechanics as the foundations of our generalized theories, and construct covering theories via *broader realizations* of the same axioms solely applicable for broader physical conditions.

Above all, the most fundamental requirement of our studies is that of *preserving the abstract Lie axioms and merely subjecting them to broader realizations valid for additional nonlinear, nonlocal and nonpotential-nonhamiltonian-nonunitary effects.* As we shall see, this condition alone guarantees that the generalized theories have exactly the same axiomatic consistency of the conventional theory.

4. CATASTROPHIC INCONSISTENCY OF BROADER THEORIES BASED ON CONVENTIONAL MATHEMATICS

The next aspect important for these studies is an outline of the rather serious physical inconsistencies of generalized theories which have departed from the axiomatic structure of quantum mechanics.

To begin, let us recall that a theory is said to be *equivalent to quantum mechanics* when it can be derived from the latter via any possible unitary transform (verifying certain conditions of topological smoothness hereon ignored for simplicity).

As a consequence, *a necessary and sufficient condition for a theory to be inequivalent to quantum mechanics is that it must be outside the class of its unitary equivalence*, that is, the new theory must be connected to quantum mechanics via a *nonunitary transform* on $\mathcal{H}$ over C,

$$U \times U^{\dagger} = U^{\dagger} \times U \neq I. \qquad (4.1)$$

As such, true generalized theories must have a *nonunitary structure*, *e.g.*, their time evolution must verify law (4.1), rather than laws (3.1).

This is a first basic technical point for our studies of new energies. In fact, if the energy considered is predicted by a theory whose time evolution is unitary, that particular form of energy *is not new* according to Definition I.1.2.1.

I have devoted my research life to the study of this topic. An outline of my experience may therefore be useful for researchers in new energies, at least to avoid wasting their time in the use of basically flawed theories.

During my undergraduate studies in physics, as soon as I understood the Lie structure of quantum mechanics, Equations (3.1)-(3.3), I devoted myself to its generalization. Subsequently, as part of my Ph.D. thesis, I published in 1967 [2a] the following *parameter deformation of Lie's theory* in its finite and infinitesimal forms on $\mathcal{H}$ over C

$$A(t) = e^{iH\times q\times t} \times A(0) \times e^{-it\times p\times H},$$

$$i\, dA / dt = (A, B) = p \times A \times H - q \times H \times A =$$

$$= m\times(A\times B - B\times A) + n\times(A\times B + B\times A) = m\times[A, B] + n\times\{A, B\}, \quad (4.2)$$

where $p = m + n$ and $q = m - n$ are non-null parameters, and $\times$ represents the conventional associative product (*e.g.*, for matrices), $AB = A\times B$, $A\times(B\times C) = (A\times B)\times C$. I also published a classical counterpart of Equations (4.2) [2c], here ignored for brevity.

Prior to publishing article [2a] I spent one full year in advanced mathematical libraries in Europe to identify the type of algebra characterized by the product (A, B). I finally discovered that the product (A,B) is *Lie-admissible* according to Albert [3], that is, the product is such that the attached antisymmetric product (A, B) - (B, A) = $(p+q)\times[A, B]$ is Lie. I therefore released paper [2a] for publication in a physics journal, but only after quoting all papers in Lie-admissible algebras at that time (three in total and solely existing in the pure mathematical literature).

I should indicate for clarity that Albert and the other two papers treated Lie-admissibility on abstract mathematical grounds. Explicit realization (4.2) was introduced in paper [2a] for the first time.

In 1968 I emigrated to the U.S. and soon discovered that, as a physicist, the study of Lie-admissible algebras would prevent my getting any faculty position anywhere because these algebras were excessively outside the trends of the time and, in any case, totally unknown in physics and virtually unknown in mathematics. Therefore, I had to spend several years in writing aseptic career-type articles at *Physical Review* and similar journals of the establishment.

When at Harvard University back in 1978 under DOE support, I resumed full time study of the issues and published paper [2d] in 1978 indicating the insufficiency of the parameter generalization (4.2) and suggesting the following *general Lie-admissible equations* defined on conventional Hilbert spaces over conventional fields (first proposed in [2d], Equations (4.15.34) and (4.18.11) and monograph [2f]).

$$A(t) = U \times A(0) \times U^{\dagger} = e^{iH\times Q\times t} \times A(0) \times e^{-it\times P\times H}, \quad P = Q^{\dagger},$$

$$i\, dA / dt = (A, B) = A < B - B > A = A \times P \times H - H \times Q \times A =$$

$$= (A\times T\times B - B\times T\times A) + (A\times W\times B + B\times W\times A) = [A, B] + \{A, B\}, \quad (4.3)$$

where $P = T+W$ and $Q = T-W$ are nowhere singular operators (or matrices).

I then introduced as a particular case the following *general Lie-isotopic equations* on $\mathcal{H}$ over C, first presented in [2d] of 1978, Equations (4.15.49) (see also monograph [2f] of 1983)

$$A(t) = U \times A(0) \times U^{\dagger} = e^{iH\times T\times t} \times A(0) \times e^{-it\times T\times H}, \quad T = T^{\dagger},$$

$$i\, dA / dt = A \hat{\times} H - H \hat{\times} A = A\times T\times H - H\times T\times A = [A, B] \quad (4.4)$$

and proposed the construction of the *hadronic mechanics* [2d,2f] with fundamental Lie-isotopic equations (4.4) for closed-isolated systems for which $idH/dt = H\hat{\times}H - H\hat{\times}H = 0$, and the general Lie-admissible equations (4.3) for open-nonconservative systems for which $idH/dt = H\times P\times H - H\times Q\times P \neq 0$.

It is a useful exercise for the reader interested in learning the formalism of these papers to prove that: 1) time evolution (4.2) is nonunitary, $U\times U^{\dagger} \neq I$; 2) the application of another nonunitary transform $R\times R^{\dagger} \neq I$ to structure (4.2) yields precisely the broader structure (4.3) by essentially transforming the parameters p and q into the operators $P = p\times(R\times R^{\dagger})^{-1}$ and $Q = q\times(R\times R^{\dagger})^{-1}$; and 3) the application of any additional nonunitary transforms $S\times S^{\dagger} \neq I$ to structure (4.3) preserves the same structure, although with different versions of the P and Q operators. This essentially proves the following:

THEOREM 4.1: General Lie-admissible laws (4.3) are "directly universal" (Section 1) for all infinitely possible (well-behaved) operator generalizations of Lie's theory admitting a consistent algebra in their infinitesimal form (i.e., a product verifying the distributive and scalar laws).

By no means have I been the only researcher to look for generalized theories. In fact, the lack of "final character" of structures (3.1)-(3.3) has been perceived by various researchers throughout this century. Numerous generalizations of quantum mechanics have, therefore, been attempted via the relaxation of one or the other of the main axiomatic principles of the theory.

First, numerous theories have been proposed with the *relaxation of the unitary structure of quantum mechanics.* It is important to see that *all these generalizations are particular cases of general laws (4.3)*, such as:

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1) Dissipative nuclear and other theories characterized by an imaginary potential [4]. These theories have nonhermitean Hamiltonian, $H = H_0 = iV \neq H^\dagger$ [4], and consequentially violate quantum structures (3.2). These theories are particular cases of laws (4.3) with $H = H_0 \times P$, $H_0 = H_0 \dagger$, $P\dagger = Q$. Their Lie-admissible reformulation is not a mere mathematical curiosity, because *dissipative nuclear models with nonhermitean Hamiltonians lose all algebras in the brackets of their time evolution (requiring a bilinear product) in favor of a triple system.* In fact, the finite time evolution assumes the evident nonunitary form $A(t) = [\exp(i \times H \times t)] \times A(0) \times [\exp(-it \times H\dagger)]$ with infinitesimal version $i dA/dt = A \times H^\dagger - H \times A = [A, H, H^\dagger]$ which is no longer bilinear, as requested for any algebra. Contemporary papers on these dissipative nuclear models perpetrate sheer scientific deception when considering "protons and neutrons" as conventionally understood, trivially, because their definition (*e.g.*, for the spin) mandates the presence of a consistent algebra. The Lie-admissible reformulation reconstructs a consistent algebra in the brackets of the time evolution, $[A, H, H^\dagger] = (A \hat{\times} H_0)$ as a condition to do physics..

2) Statistical theories with an external collision term C and equations of motion of the density $i d\rho/dt = \rho \circ H = [\rho, H] + C$, $H = H^\dagger$ [5], which violate the conditions for the product $\rho \circ H$ to characterize any algebra, as well as exponentiation law (3.1), let alone the conditions of unitarity. These theories are a particular case of the general Lie-admissible theory (4.3) with $P = I$ and $Q = I + (\rho \times H)^{-1} \times C$. Again, the Lie-admissible reformulation reconstructs a consistent algebra which would be otherwise absent.

3) The so-called "q-deformations" of the Lie product $A \times B - q \times B \times A$ [6], where q is a non-null scalar, which are a trivial particular case of structures (4.2).

4) The so-called "k-deformations" [7] which are a relativistic version of the q-deformations, thus also being a particular case of general structures (4.2), (4.3).

5) The so-called "star deformations" [8] with generalized associative product $A * B = A \times T \times B$, T fixed, and generalized Lie product $A * B - B * A$, which violate structures (3.1)-(3.3) and *coincide* with Santilli's Lie-isotopic laws (4.4) even in the symbols used.

6) Deformed creation-annihilation operators theories [9].

7) Nonunitary statistical theories [10].

8) Irreversible black holes dynamics [11] with Santilli's Lie-admissible structure (4.3).

9) Noncanonical time theories [12].

10) The so-called supersymmetric theories [13] with product $(A, B) = [A, B] + \{A, B\} = (A \times B - B \times A) + (A \times B + B \times A)$, which are an evident particular case of Santilli's Lie-admissible product (4.3) with $T = I$ and $W = I$.

11) The Kac-Moody superalgebras [14], which are also a particular case of Santilli's Lie-admissible product (4.3) with $T = I$ and W a phase factor.

12) The string theories [28], which have a supersymmetric structure with consequential time evolution which is non-canonical at the classical level and nonunitary at the operator level.

13) Grand unified theories on a curved manifold (see the review in [28a]) whose time evolution is also noncanonical at the classical level and nonunitary at the operator level.

Despite their unquestionable mathematical beauty, all the above theories (beginning with my own) possess the following physical inconsistencies which have been called "catastrophic" in the literature [15,16]:

THEOREM 4.2: All theories possessing a nonunitary time evolution formulated on conventional Hilbert spaces $\mathcal{H}$ over conventional fields of complex numbers $C(c, +, \times)$ *do not admit consistent physical applications because:*

1) They do not possess invariant units of time, space, energy, etc., thus lacking any physically meaningful application to experimental measurements;

2) They do not conserve Hermiticity in time, thus lacking any physically meaningful observables;

3) They do not possess unique and invariant numerical predictions;

4) They generally violate causality and probability laws; and

5) They violate the basic axioms of Einstein's special relativity.

A comprehensive treatment is presented in memoir [16]. I here recall only the following main points.

The most fundamental drawback of the theories considered is their *lack of invariance*. This can be best illustrated with the lack of invariance of the general Lie-admissible laws (4.3), which admit as a particular case all other nonunitary theories. In fact, under nonunitary transforms $U \times U\dagger \neq I$ we have, *e.g.*, the lack of invariance of the Lie-admissible brackets

$$
\begin{aligned}
U \times (A \hat{\times} B) \times U^\dagger &= U \times (A < B - B > A) \times U^\dagger = \\
&= (U \times A \times U^\dagger) \times ((U \times U^\dagger)^{-1}) \times (U \times P \times U^\dagger) \times (U \times U^\dagger)^{-1}) \times (U \times B \times U^\dagger) - \\
&\quad - (U \times B \times U\dagger) \times ((U \times U^\dagger)^{-1}) \times (U \times Q \times U^\dagger) \times (U \times U^\dagger)^{-1}) \times (U \times A \times U^\dagger) = \\
&= A' \times P' \times B' - B' \times Q' \times A' = A' < ' B' - B' > ' A' \\
P' &= (U \times U^\dagger)^{-1}) \times (U \times Q \times U^\dagger) \times (U \times U^\dagger)^{-1}, \quad Q' = (U \times U^\dagger)^{-1}) \times (U \times Q \times U^\dagger) \times (U \times U^\dagger)^{-1}
\end{aligned}
\tag{4.5}
$$

The above rules confirm the preservation of a Lie-admissible structure under the most general possible transforms, thus confirming the direct universality of laws (4.3) as per Theorem 4.1. The point is that *the formulations are not invariant because* $P' \neq P$ *and* $Q' \neq Q$.

More explicitly, the invariance of quantum mechanics follows from the fact that the associative product "$\times$" is not changed in Equation (3.3). By comparison, the generalized products "$<$" and "$>$" of broader theories (4.3) is changed by the transformations, including the time evolution of the theory itself. The same results hold for the simpler Lie-isotopic case (4.4).

The physical implications of this lack of invariance are disastrous and can be summarized as follows. When working on a conventional Euclidean space, its basic geometric unit I = Diagonal Matrix (1, 1, 1) provides a dimensionless representation of the basic units of length in each space direction, I = Diag. (1 cm, 1 cm, 1 cm). It then follows that, by their very conception, the nonunitary time evolution of theories [2-14] *does not* preserve these basic units, $I' = U \times I \times U^\dagger \neq I$, with similar occurrences for other units. This prevents meaningful applications, because a necessary condition for valid measurements is the invariance of the basic units.

Similarly, it is easy to prove that the condition of Hermiticity at the initial time, $(< \phi | \times H\dagger) \times | \phi > = < \phi | \times (H \times | \phi >)$ is violated at subsequent times for all theories with nonunitary structures when formulated on $\mathcal{H}$ over C,

$$
\begin{aligned}
&[< \psi | \times U^\dagger \times (U \times U^\dagger)^{-1} \times U \times H \times U^\dagger) \times U | \psi > = \\
&= < \psi | \times U^\dagger \times (U \times H \times U^\dagger) \times (U \times U^\dagger)^{-1} \times U | \psi >] = \\
&= (< \hat{\psi} \times T \times \hat{H}^\dagger) \times | \hat{\psi} > = < \hat{\psi} | \times (\hat{H} \times T \times | \hat{\psi} >), \\
&| \hat{\psi} > = U \times | \psi >, \quad \hat{T} = (U \times U^\dagger)^{-1} = T\dagger, \\
&\hat{H}^\dagger = T^{-1} \times \hat{H} \times T \neq H
\end{aligned}
\tag{4.6}
$$

As a result, all theories [2-14] do not admit physically meaningful observables.

Causality and probability laws are notoriously based on the unitary character of time evolution (3.1). Their violation for all theories [2-14] is then evident.

The violation of the basic axioms of Einstein's special relativity by all theories [2-14] is so evident as to require no comment.[4]

The mathematical inconsistencies are equally catastrophic. In fact, the loss of the basic unit indicated above implies the evident

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loss of the field of numbers on which the theories are defined. As a result, the entire mathematical structure assumed at the initial time is no longer applicable at subsequent times, because vector and Hilbert spaces, algebras and groups, geometries and topologies, etc. are *all* defined on the initial field which is no longer applicable at subsequent time, since it has lost its basic unit.

Next, additional generalized theories were attempted via *the relaxation of the linear character of quantum mechanics*. These theories (see, *e.g.*, [17]) are essentially based on eigenvalues equations with the structure $H(t, r, p, \phi)\times\phi = E\times\phi$ (*i.e.*, H depends on the wavefunction).

Even though mathematically impeccable and possessing a seemingly unitary time evolution, these theories also possess rather serious physical drawbacks, such as: they violate the superposition principle of quantum mechanics, thus being strictly inapplicable to composite systems; they violate the fundamental Mackay imprimitivity theorem [18] which is necessary for the applicability of Galilei's or Einstein's relativities; and possess other drawbacks [19] so serious as to prevent any application to the real world.

Yet another type of broader theory is *Weinberg's theory with a nonassociative envelope* [20]. This is a theory in which the associative enveloping product $A\times B$ of the Lie product $[A, B] = A\times B - B\times A$ is replaced with a certain *nonassociative* product $A\otimes B$, $A\otimes(B\otimes C) \neq (A\otimes B)\otimes C$.

The latter theory violates Okubo's No-Quantization Theorem [21], which prohibits the use of nonassociative envelopes because of catastrophic physical consequences, such as the loss of equivalence between the Schrödinger and Heisenberg's representations (the former remains associative, while the latter becomes nonassociative, thus resulting in inequivalence, with consequential inconsistency of the entire theory).

Weinberg's theory also has additional catastrophic inconsistencies, studied in detail in [22], such as: the complete absence of any unit at all, let alone its lack of invariance (because of the lack of a nontrivial quantity E such that $E\otimes A = A\otimes E \quad A, \forall A$) with consequential impossibility of applying the theory to any measurement of any type; the violation of Galilei's and Einstein's relativities (because of the loss of exponentiation); and others.

Several authors also attempted *the relaxation of the local-differential character of quantum mechanics*. The attempt was done via the addition of "integral potentials" $V = \int d\tau\ \Gamma(\tau,...)$ in a Hamiltonian.

These theories are worse than all the preceding ones, because they are structurally flawed on both mathematical and physical grounds. The nonlocal extension is elaborated via the conventional mathematics of quantum mechanics. But the mathematics of the latter, beginning with its topology, is strictly local-differential, thus implying fundamental *mathematical* inconsistencies. Nonlocal interactions are in general of contact type for which the notion of a potential has no physical meaning, thus resulting in catastrophic *physical* inconsistencies.

The above occurrences prevent the use of nonlinear, nonlocal, and nonunitary theories for any serious study of new energies when treated with conventional mathematics.

For completeness I should mention without treatment the following additional inconsistencies (studied in detail in memoir [16]):

THEOREM 4.3. All classical theories with a noncanonical structure formulated on conventional metric spaces over conventional fields do not possess consistent physical applications because of the lack of invariant units, invariant time evolutions, and invariant numerical results.

The best illustration is given by the Lie-admissible reformulation of the historical analytic equations, *Hamilton's equations with external terms* [2g,2i], which are "directly universal" for all conceivable classical equations.

My recent studies have established that the ensuing *Hamilton-Admissible Mechanics* I laboriously submitted in monograph [2i] has no known physical value.

Exactly the same fate recently emerged for the *Birkhoffian Generalization of Hamiltonian Mechanics* I laboriously submitted in monograph [2f] (published by one of the most prestigious scientific publishers, Springer-Verlag, in its most prestigious series of "Text and Monographs in Physics"). In fact, such a mechanics is a *noncanonical* image of the conventional Hamilton's equations of the contemporary literature (those with the external terms cut out). As such, they are noninvariant under their own action with consequential Theorem 4.3.

In conclusion, by the early 1980's I had indeed reached classical [2i] and operator [2f] formulations that are directly universal in their fields, with a plethora of simpler versions by various other authors. However, all these theories have no physical meaning known to me, because they are noninvariant.

Note that, unlike others (see the footnotes), I consider it mandatory for scientific ethics to acknowledge in plain language the inconsistencies of my own theories without any shame, because the generalization of quantum mechanics is a rather difficult task requiring a series of predictable trials and errors. Equally unlike others, I consider it mandatory for scientific ethics to identify *all* prior literature, as I have done it following laborious library searches at times lasting for years for: the first identification in physics of mathematical studies in Lie-admissibility in paper [2a]; systematic library search for the integrability conditions on the existence of a Hamiltonian in monograph [2e]; the mathematical and physical literature connected to hadronic mechanics in monographs [1-3b,1-3c]; and in other publications.

5. THE NOVEL ISO-, GENO- AND HYPER-MATHEMATICS AND THEIR ISODUALS

The history of science establishes that *there cannot be really new scientific advancements without new mathematics and, in turn, there cannot be really new mathematics without new numbers.*

The best example is Isaac Newton, who had to introduce the differential calculus as a necessary pre-requisite for the formulation of his famous physical laws. When digging beyond all subsequent basic advances in physics, new mathematics emerge and, when digging deeper, new numbers emerge (as is the case of quantum mechanics, which introduced for the first time the use in physics of complex numbers).

Intriguingly, the origin of the physical inconsistencies of Theorems 4.2 and 4.3 resulted precisely in Newton's differential calculus, which is local-differential, thus unsuited for broader nonlocal systems. In fact, all generalized theories of papers [2-14] were inconsistent because the basic equations are expressed via the conventional differential calculus. In order to achieve invariant equations of motion for the broader conditions under consideration, I had to generalize first the differential calculus in the form outlined below. Physics can be done only thereafter.

To illustrate how true this historical teaching is, allow me to make a preposterous statement. I suggest that the reader go to the most advanced mathematical library, select at random a shelf, select at random in that shelf a book or journal, and open it at any page. The math on that page *cannot* be used for quantitative studies of new energies as per Definition 1.1.2.1 with only a few exceptions.

The preposterous statement is, therefore, that the entire current mathematical knowledge is generally inapplicable for quantitative studies of new energies, with only a few (yet qualified) exceptions published in *Rendiconti Circolo Matematico Palermo; Algebras, Groups and Geometries; Mathematical Methods in Applied Sciences; Journal of Balkan Geometry Society; Acta Applicandae Matematicae; (Indian) Journal of Mathematics*; and other mathematics journals.

Rather than being preposterous, the statement is true. In fact, conventional mathematics is based on conventional numbers (real,

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complex, quaternions, and octonions), while the new mathematics is based on new numbers, as we shall see. Besides, the existing mathematics is local-differential, while we need a nonlocal mathematics to treat new energies. The very few ore-existing integral geometries are unsuited to construct covering physical theories because they do not admit local-differential methods as a clear particular case, or are unable to permit a separation of local-differential and nonlocal-integral effects crucial for physics insights.

After having identified the lack of physical applicability of pre-existing generalized theories, as a physicist I had to construct basically novel mathematical methods as a condition to conduct novel physical inquiries.

While at the Department of Mathematics of Harvard University under DOE support, I proposed [2g] in 1978 the construction of a sequence of novel mathematics of increasing complexity for the description of systems of increasing methodological needs. I then continued to study the new mathematics in subsequent years (see the recent mathematical memoir [1-3e] and monograph [1-3f]). The same mathematics have been studied by various pure and applied mathematicians (see the monograph [1-3i-1-3l] and recent papers [23] for comprehensive references), and has now reached operational maturity.

The main idea I proposed in 1978 is the generalization (also called *lifting*) of the trivial n-dimensional unit I = Diag. (1, 1, ..., 1) of conventional mathematics into a generalized n×n-dimensional matrix (or operator) $\hat{1}$ which is everywhere invertible, Hermitean and positive-definite as I, yet possesses an unrestricted functional dependence on all needed local variables, such as time t, coordinates r, velocities v, wavefunctions ϕ, etc.,

$$I = \text{Diag.}\ (1, 1, ..., 1) \rightarrow \hat{1} = \hat{1}(t, r, v, \phi, ...) = 1/\hat{T} = \hat{1}^{\dagger} > 0. \tag{5.1}$$

The new mathematics then follows from the reconstruction of the entire original formalism in such a way to admit $\hat{1}$, rather than I, as the correct left and right new unit.

Since $\hat{1}$ preserves the topological characteristics of I, the liftings under consideration here were submitted under the name of *isotopies* [2e] in the Greek meaning of being "axiom-preserving." The ensuing mathematics is then called *Santilli's isomathematics*.

Its construction requires, first, the lifting of the conventional associative product A×B (= AB) among generic quantities A, B (such as numbers, matrices, operators, etc.) into the product

$$A \hat{\times} B = A \times \hat{T} \times B, \tag{5.2}$$

where $\hat{T}$ is fixed for all products, under which $\hat{1} = 1/\hat{T}$ is the correct left and right unit of the new theory called the *isounit*,

$$\hat{1} \hat{\times} A = \hat{T}^{-1} \times \hat{T} \times A = A \hat{\times} \hat{1} = A \times \hat{T} \times \hat{T}^{-1} = A \tag{5.3}$$

while $\hat{T}$ is called the *isotopic element*.

The product $A \hat{\times} B$ is then called *isoassociative* (or *isoproduct* for short) because it preserves the original axiom of associativity, $A \hat{\times} (B \hat{\times} C) = (A \hat{\times} B) \hat{\times} C$. We then have the following isotopic liftings:

1) Conventional real numbers n, m, etc., with trivial unit 1 and product nm = n×m are lifted into the *isonumbers* [1-3h] $\hat{n} = n \times \hat{1}$, $\hat{m} = m \times \hat{1}$, etc. with conventional sum +, *isoproduct* $\hat{n} \hat{\times} \hat{m} = \hat{n} \times \hat{T} \times \hat{m} = (n \times \hat{1}) \times \hat{T} \times (m \times \hat{1}) = (n \times m) \times \hat{1}$, *isoquotient* $\hat{n} \hat{/} \hat{m} = (\hat{n}/\hat{m}) \times \hat{1}$, and other generalized operations characterizing the *isofield* $\hat{R}(\hat{n}, +, \hat{\times})$. Similar generalizations occur for complex numbers, quaternions and octonions [1-3h,1-3e];

2) The conventional differentials dr^k of the Euclidean coordinates r^k, k = 1, 2, 3 (= x, y, z), are lifted into the *isodifferential* [1-3e]

$$\hat{d}r^k = \hat{1}^k{}_j(t, r, v, \phi, ...) \times dr^j; \tag{5.4}$$

the conventional derivatives $\partial/\partial r^k$ are lifted into the *isoderivative* with related main property (see again [1-3e] for details)

$$\hat{\partial}/\hat{\partial} r^k = \hat{T}_k{}^i \times \partial/\partial r^i; \quad \hat{\partial} r^i \hat{/} \hat{\partial} r_j = \delta^i_j = \delta^i_j \times \hat{1}; \tag{5.5}$$

3) Corresponding compatible generalizations occur for *all* remaining aspects of conventional mathematics, including metric and Hilbert spaces, conventional and special functions and transforms, algebras, groups and geometries, topologies, etc. [1-3,23].

A salient feature of the isomathematics is that of preserving all original axioms by construction. This is an evidently important feature that assures the preservation of the original physical consistency, as we shall see in the next section.

It should be stated to prevent misrepresentations that *the preservation of the original axioms occurs only in isospaces over isofields (i.e., when referred to generalized units) and not necessarily in their projection in conventional spaces over conventional field (i.e., when referred to the conventional unit).*

As an illustration, isoderivatives isocommute on isospaces, $\hat{\partial}_i \hat{\partial}_j = \hat{\partial}_j \hat{\partial}_i$, but they do not generally commute when projected on conventional spaces, $\hat{T}_i{}^m(r) \times a_m \hat{T}_j{}^n(r, ...) \times a_n \neq \hat{T}_j{}^m(r, ...) \times a_m \hat{T}_i{}^n(r) \times a_n$ evidently because of the general dependence of the isotopic element $\hat{T}$ on the local variable. A similar occurrence holds for most of the remaining properties.

A knowledge of isomathematics as given, e.g., in [1-3e] (which we cannot possibly review here for brevity) is tacitly assumed hereon for an in-depth technical understanding of these papers. The reader is warned that any appraisal of these papers via conventional mathematics (e.g., under the assumption that "2 × 2 = 4") is afflicted by a number of insidious inconsistencies which generally remain undetected by nonexperts. As an illustration "2 × 2 = 12" for $\hat{1}$ = 3, or the number 4 becomes *prime* for $\hat{1}$ = 4.

In 1978 I also proposed the broader *genomathematics* [2e], which is characterized by the relaxation of the Hermiticity of the generalized unit. This implies the existence of *two different generalized units*, called *genounits* and related *genoproducts*, which are denoted by

$$\begin{gathered} {}^{<}\hat{1} = 1/\hat{P}, \quad A < B = A \times \hat{P} \times B, \quad {}^{<}\hat{1} < A = A < {}^{<}\hat{1} = A, \\ \hat{1}^{>} = 1/\hat{Q}, \quad A > B = A \times \hat{Q} \times B, \quad \hat{1}^{>} > A = A > \hat{1}^{>} = A, \\ \hat{1}^{>} = ({}^{<}\hat{1})^{\dagger}, \end{gathered} \tag{5.6}$$

where $\hat{P}$ and $\hat{Q}$ are again fixed for all products.

In this case we have *two* independent generalizations, one for *the ordered product to the left* $A<B = A \times \hat{P} \times B$ and related unit $<\hat{1}$, and one for the *ordered product to the right* $A>B = A \times \hat{Q} \times B$ and related unit $\hat{1}>$. These two products are then interconnected by Hermitean conjugation (5.6c).

This implies the existence of a *dual* lifting of the *entire* conventional mathematics of quantum mechanics, including [1-3b,1-3e]: a) *forward and backward genonumbers* $n^{>} = n \times \hat{1}^{>}$, ${}^{<}n = {}^{<}\hat{1} \times n$ with corresponding *genoproducts* $n^{>} > m^{>} = (nm) \times \hat{1}^{>}$ and ${}^{<}n < {}^{<}m = {}^{<}\hat{1} \times (nm)$; b) *forward and backward genodifferentials and genoderivatives*

$$\begin{gathered} d^{>}\hat{1}^k = \hat{1}^{>k}{}_i \times dr^i, \quad {}^{<}dr^k = {}^{<}\hat{1}^k{}_i \times dr^i; \\ \partial^{>}/\partial^{>}\hat{1}^k = Q_k{}^i \times \partial/\partial r^i, \quad {}^{<}\partial/{}^{<}\partial r^k = P_k{}^i \times \partial/\partial r^i. \end{gathered} \tag{5.7}$$

and c) corresponding dual liftings for all remaining methods.

I submitted the above broader liftings under the name of *genotopies* [2e] from the Greek meaning of being "axiom-inducing," that is, of mapping conventional into covering axioms which admit both the conventional and isotopic realizations as particular cases. The resulting new mathematics is today called *Santilli's genomathematics*.

I also submitted more recently the still broader *hypermathematics* [1-3e], which is characterized by the relaxation of the single-valued character of the genounits. This implies two generalized, nonhermitean and multivalued units, called *hyperunits*, each with its own ordered *hyperproducts* and

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conjugation

$$^{<}I = (\,^{<}I_1, \,^{<}I_2, \quad ,) = 1/P = (\,^{<}I)^{\dagger},$$

$$A < B = (A\times\hat{P}_1\times B,\ A\times\hat{P}_2\times B, \ldots)\ ^{<}I < A = A < {}^{<}I = A,$$

$$I^{>} = (I^{>}_1, I^{>}_2, \quad , I^{>}_N) = 1/\hat{Q},$$

$$A > B = (A\times\hat{Q}_1\times B, A\times\hat{Q}_2\times B, \ldots),\ I^{>} > A = A > I^{>} = A, \quad (5.8)$$

In this case we have the *forward and backward hypernumbers* $n^{>}\times m^{>} = ((nm)\times I^{>}_1, (nm)\times I^{>}_2, \ .)$, with multivalued products such as $^{<}n\times{}^{<}m = (^{<}I_1\times(nm), \ ^{<}I_2\times(nm), \ .)$; the *forward and backward hyperdifferentials, hyperderivatives, hyper-functions, hyperspaces, etc.* The resulting new mathematics is today called *Santilli's hypermathematics.*

Another preposterous statement is that the simple lifting of the unit, equation (5.1), implies a sequence of generalizations of the entire contemporary mathematics admitting a unit. Rather than being preposterous, the statement is true because the entire pre-existing mathematical knowledge has been restricted to the simplest possible unit I, as the reader is encouraged to verify. The statement also illustrates the truly fundamental character of the unit for all possible mathematical and physical theories.

The need for the above sequence of generalized mathematics is the following. As we shall see, isomathematics permit a resolution of certain insufficiencies of quantum mechanics. However, being "axiom-preserving," isomathematics has its own limitations since it preserves the essential characteristics of quantum mechanics, and, therefore, can only represent systems which are *reversible in time* and verify *total conservation laws.* As such, isomathematics is adequate for the representation of *the structure of hadrons, nuclei, atoms, molecules, stars and other interior problems when considered as isolated from the rest of the universe* with linear and nonlinear, local and nonlocal and Hamiltonian as well as nonhamiltonian interactions. The former are represented by a conventional Hamiltonian and the latter by the isounit. However, isomathematics is transparently insufficient to represent *irreversible* systems, such as chemical reactions.

Genomathematics resolves the latter insufficiency because it is *structurally irreversible* [2e,I-3f]. In fact, motion forward (backward) in time can be represented with forward (backward) products A>B (A<B). Since these products are different, the theories forward and backward in time are different, and irreversibility follows. Time reversal is then ensured by conjugation (5.6c).

Despite that, genomathematics has its own limitations when facing more difficult interior problems, such as *biological structures,* whose complexity is beyond human imagination, *e.g.,* because they are multivalued [I-3f].

Hypermathematics resolves the latter insufficiency because it is as irreversible as genomathematics, yet it adds an unlimited number of representational capabilities due to its multivalued character.

It is evident that hypermathematics admits as a particular case genomathematics when the hyperunits are reduced to a single nonhermitean quantity. In turn, genomathematics admits as a particular case isomathematics when the generalized unit returns to being Hermitean. Finally, isomathematics admits conventional mathematics as a trivial particular case when the isounits assume the value I.

It is important to indicate the following examples of generalized units already in these introductory lines, because they can be of guidance for the understanding of subsequent aspects:

$$\hat{1} = \mathrm{Diag.}\,(n_1^2, n_2^2, n_3^2)$$

$$\hat{1} = \exp\{N\int dr^3\, \psi^{\dagger}_{\uparrow}(r)\, \psi_{\downarrow}(r)\},$$

$$\hat{1} = \begin{pmatrix} 1 & \{1 - \exp\{N\int dr^3\, \psi^{\dagger}_{\uparrow}(r)\, \psi_{\downarrow}(r)\}\} \\ \{1 - \exp\{N\int dr^3\, \psi^{\dagger}_{\uparrow}(r)\, \psi_{\downarrow}(r)\}\} & 1 \end{pmatrix} \quad (5.9)$$

As we shall see in Paper III, isounit (5.9a) is used for the characterization of extended, nonspherical (in this case ellipsoidical) and deformable shapes of protons and neutrons; isounit (5.9b) is used for the characterization of the nonlocal-nonpotential conditions of deep wave overlappings (Figure II-2); and isounit (5.9c) is used for the fit of the experimental data on Bose-Einstein correlation [I-15].

Note that none of the features represented by isounits (5.9) can be represented via a Hamiltonian. Irrespective of all the arguments of Paper I, this feature alone is sufficient to establish the insufficiencies of quantum mechanics, trivially, because such a theory is purely Hamiltonian. Note also that all isounits (5.9) admit the trivial unit I of quantum mechanics as a particular case. The latter condition is evidently necessary for hadronic mechanics to be a *covering* of quantum mechanics.

Numerous other generalized units have been identified depending on the problem at hand and they will be considered in subsequent papers.

As the third preposterous statement of this section, permit me to suggest again that the reader go to an advanced mathematics library and select at random any mathematical presentation, including those on iso-, geno- and hyper-mathematics. The statement is that the totality of the existing mathematics, including that outlined above in this section, is incapable of providing a consistent *classical* representation of antimatter.

As indicated in Paper I, the map from matter to antimatter must be anti-isomorphic like charge conjugation in *second* quantization. But current science possesses only *one channel of quantization, the conventional one.* The use of any conventional or generalized mathematics for the classical treatment of antimatter then implies operator images that *do not* constitute antiparticles, but merely particles with the wrong sign of the charge (because reached with the same quantization channel of particles).

In view of these and other inconsistencies, in order to achieve a consistent classical representation of antimatter, as a physicist, I had to study additionally new mathematics specifically constructed for the task.

After laborious search, I introduced in 1985 [25b] the map of an arbitrary quantity A (and related spaces) called *isoduality* for certain technical reasons

$$A(r, \psi, \ldots) \rightarrow A^d(r^d, \psi^d, \ldots) = -A^{\dagger}(-r^{\dagger}, -\psi^{\dagger}, \ldots),$$

$$A\hat{\times}B = A\times\hat{1}\times B \rightarrow A\,\hat{\times}^d\,B = A\times(-\hat{1}^{\dagger})\times B = -A\times\hat{1}^{\dagger}\times B. \quad (5.10)$$

As one can see, the main idea was essentially that of assuming, for the first time in mathematical history, *negative definite units,* and then reconstructing the entire conventional, iso-, geno- and hyper-mathematics in such a way to admit $-\hat{1}^{\dagger}$, rather than $\hat{1}$, as the correct left and right unit. This implies isodual images of all various notions considered above, resulting in a yet novel mathematics today called *Santilli's isodual mathematics* [I-3e].

In particular, isodual mathematics possesses a *negative norm,* which implies the reversal of the sign of all physical characteristics of particles, thus providing the desired anti-isomorphic image of matter applicable at all levels, including the classical one. Moreover, isodual mathematics identifies a new channel of quantization, specifically, for antimatter. As such, isodual mathematics has resulted to be particularly suited to represent *antimatter* (see [I-3g]) beginning at the classical level and then persisting at the operator level, where it becomes equivalent to charge conjugation. These papers deal solely with *matter* and, as such, isodual mathematics shall not be considered for brevity.

6. CLASSICAL AND OPERATOR ISO-, GENO-, AND HYPER-MECHANICS AND THEIR ISODUALS

6.1. Introduction

In 1978 I submitted [2d] a generalization of quantum mechanics under the name of *hadronic mechanics* based on general Lie-admissible equations (4.3) for open-nonconservative systems with

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unrestricted interactions and the simpler Lie-isotopic equations (4.4) for closed-isolated systems with nonhamiltonian internal effects.

The new mechanics was subsequently studied by numerous mathematicians, theoreticians and experimentalists in over one thousand papers, twenty advanced monographs, and over thirty volumes of conference proceedings (see their listing in the IBR Web Site). I apologize for being unable to quote them on an individual basis because they are too numerous (see Vols. [1-3b,1-3c] for comprehensive literature up to 1995 and representative papers [24]).

The reader should be made aware up front that all publications on hadronic mechanics (including mine) prior to 1996 are *physically inconsistent* due to lack of full invariance, which was recently achieved in memoir [1-3d] published in *Foundations of Physics* Vol. 27 of 1997, following the prior achievement of mathematical maturity at *Rendiconti Circolo Matematico Palermo*, Suppl. Vol. 42 (1996), and maturity in generalized symmetries in memoir [23a] published in *M mathematical Methods in Applied Sciences*, Volume 19, 1996, as well as monographs [1-3j,1-3k,1-3l]. As a result of these collegial efforts, hadronic mechanics has now reached the operational maturity first presented in recent memoir [1-3d].

Today hadronic mechanics comprises the following formulations for the description of *matter*:

Classical Hamiltonian mechanics	*quantization*	*Conventional quantum mechanics*
Classical isohamiltonian mechanics	*isoquantiz.*	*Operator isohamilt. mechanics*
Classical genohamilt. mechanics	*genoquantiz.*	*Operator genohamilt. mechanics*
Classical hyperhamilt. mechanics	*hyperquantiz.*	*Operator hyperhamilt. mechanics*

plus the anti-isomorphic isoduals of all the preceding formulations for the description of antimatter. Moreover, *each* of the above formulation is divided into *nonrelativistic and relativistic treatments* with *field theoretical extensions* under construction at this writing.

The above formulations are used for the classical and operator treatment of: reversible systems of particles at large mutual distances in exterior conditions in vacuum with only Hamiltonian interactions (conventional mechanics); reversible systems of particles in interior conditions with Hamiltonian and nonhamiltonian interactions (isomechanics); irreversible systems of particles in interior conditions (genomechanics); and multi-valued irreversible systems of particles in interior conditions (hypermechanics).

It is evident that I cannot possibly review in this paper all the above thirty-two different formulations (excluding the twelve additional quantum field theoretical extensions). In this section I shall, therefore, merely indicate the most recent references of the various aspects and outline only the basic lines important for new energies.

6.2. Nonrelativistic Classical Isomechanics

A misconception of contemporary theoretical physics is the rather widespread belief that the validity of the conventional ten, Galilean or Einsteinian, *total conservation laws* (for the conservation of the total energy, linear momentum, angular momentum, and uniform motion of the center of mass) necessarily imply conservative internal forces derivable from a potential.

This belief is dramatically disproved by the observation (and admission) of nature, such as the visual inspection of Jupiter's structure under a telescope which, when considered as isolated from the rest of the universe, does indeed verify the celebrated ten total conservation laws, yet its internal structure is dramatically nonpotential-nonhamiltonian, as manifested by vortices with *variable angular momenta*, irreversible internal processes, entropy, etc. (Technically, Jupiter's internal equations violate the integrability conditions for the existence of a potential or a Hamiltonian, the conditions of *variational selfadjointness* studied in detail in monographs [2e,2f].)

I, therefore, spent a considerable number of years of my research life to construct, first, a classical mechanics capable of an invariant description of *closed-isolated systems verifying conventional total conservation laws, yet possessing conservative-potential, as well as nonconservative-nonpotential internal forces*. Quantization and operator versions were studied only thereafter because no new operator theory can pass the test of time without a sound classical counterpart.

As recalled in Section 4, for the above purpose I first constructed the *Birkhoffian Generalization of Hamiltonian Mechanics* with a Lie-isotopic structure [2f] and then the broader *Hamilton-Admissible Mechanics* with a Lie-admissible structure [2i]. Unfortunately, both these mechanics resulted in subsequent studies to be noninvariant, thus without physical validity.

Therefore, I had to restart from the beginning and constructed the *Hamilton-isotopic mechanics* which was first presented in monograph [1-3c] of 1993. However, I subsequently discovered that this latter mechanics too had no physical meaning, because it was also noninvariant.

After laborious search, I finally identified the lack of invariance where I was expecting it the least, in the use of Newton's historical *ordinary differential calculus*.

It was only after the publication of memoir [1-3e] of 1996 on the isodifferential calculus that I finally reached the desired invariance, as well as mathematical and physical maturity.

The invariant formulation of the classical nonrelativistic isonewtonian/isohamiltonian mechanics can be outlined as follows.

The fundamental notions of Hamiltonian mechanics in phase space and in CGS units are: the conventional, Euclidean *space-unit* I_r = Diag. (1 cm, 1 cm, 1 cm), *momentum unit* I_p = Diag. (1 cm/sec, 1 cm/sec, 1 cm/sec) and time unit I_t = 1 sec, geometrically expressed in the usual dimensionless forms $I_r = I_p = I$ = Diag. (1, 1, 1) and $I_t = 1$; the related fields $R_r = R_p = R(n, +, \times)$ and $R_t = R(t,+,\times)$; the basic Euclidean carrier space characterized by the well known Kronecker product of Euclidean spaces $E_{Tot} = E_t(t,R_t) \times E(r,\delta,R_s) \times E(p,\delta,R_s)$, where $r = (r_k)$, $p = (p_k)$, $k = 1, 2, 3$, δ = Diag. (1, 1, 1); the intervals are given by $r2 = r_i \times \delta_{ij} \times r_j \in R$, $p2 = p_i \times \delta_{ij} \times p_j \in R$, $r = r_1 - r_2$, $p = p_1 - p_2$; and the ensuing theory (action principle, Hamilton and Hamilton-Jacobi equations, classical realization of Lie's theory, Euclidean and symplectic geometries, etc.).

The fundamental notions of the *classical nonrelativistic isomechanics* are:

1) The basic isounits

$$\begin{aligned} &\textit{space isounit } \hat{I}_r = \hat{I} = (\hat{I}^i_j) = \hat{T}^{-1} = (\hat{T}_i^j)^{-1} > 0, \\ &\textit{momentum isounit } \hat{I}_p = \hat{T} = \hat{I}^{-1} > 0 \text{ and} \\ &\textit{time isounit } \hat{I}_t > 0, \end{aligned} \tag{6.2.1}$$

which can be always diagonalized into the form

$$\begin{aligned} &\hat{I}_r = \hat{I} = \text{Diag.}\,(\hat{I}_{11}, \hat{I}_{22}, \hat{I}_{33}), \\ &\hat{I}_p = \hat{T} = \text{Diag.}\,(\hat{T}_{11}, \hat{T}_{22}, \hat{T}_{33}) \text{ and} \\ &\hat{I}_t \text{ a real valued nowhere null function;} \end{aligned} \tag{6.2.2}$$

2) The isofields $\hat{R}_r(\hat{n}+,\hat{\times})$ with Isounit $\hat{I}$, $\hat{R}_p(\hat{m},+,\hat{\times})$ with isounit $\hat{T}$, and $\hat{R}_t(\hat{t}+,\hat{\times})$ with isounit $\hat{I}_t$;

3) The basic carrier isospaces given by *Santilli's isoeuclidean spaces* (first introduced in [2g] of 1978)

$$\hat{E}_{Tot} = \hat{E}_t(\hat{t},\hat{R}_t) \times \hat{E}(\hat{r},\hat{\delta}_r\hat{R}_r) \times \hat{E}(\hat{p},\hat{\delta}_p,\hat{R}_p), \tag{6.2.3}$$

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with *isocoordinates, isomomenta and isometrics*

$$\hat{r} = r\times\hat{1}_r,\ \hat{p} = p\times\hat{T}\ ;\ \hat{\delta}_r = \hat{T}\times\delta,\ \hat{\delta}_p = \hat{1}\times\delta; \qquad (6.2.4)$$

and the *isointervals*

$$\hat{r}^2 = \hat{r}^i \hat{\times} \hat{\delta}_{ij} \hat{\times} \hat{r}^j = (r^i \times \hat{\delta}_r^{ij} \times r^j) \times \hat{1}_r \in \hat{R}_r\ ,$$
$$\hat{p}^2 = \hat{p}_i \hat{\times} \hat{\delta}^{ij} \times \hat{p}_j = (p_i \times \hat{\delta}_p^{ij} \times p_j) \times \hat{1}_p \in \hat{R}_p\ , \qquad (6.2.5)$$

where $\hat{\delta}_p = (\hat{\delta}_p^{ij}) = \hat{\delta}_r^{-1} = (\hat{\delta}_{rij})^{-1}$, thus confirming the indicated isounits for r and p;

4) The isofunctional analysis comprising conventional and special isofunctions and isotransforms, isodifferential calculus, etc.;

5) The Lie-Santilli isotheory, comprising the isotopies of universal enveloping associative algebras, Lie algebras, Lie groups, Lie symmetries, representation theory; etc.

By dropping the subindex r and p in the isoproducts for simplicity, the classical nonrelativistic isomechanics is characterized by [I-3e]:

A) The *Newton-Santilli isoequations*, first introduced in [I-2e], p. 31,

$$\hat{m}\ \hat{\times}_t \frac{\partial \hat{v}_k}{\partial \hat{t}} - \hat{F}_k(\hat{t}, \hat{r}, \hat{v}) = \qquad (6.2.6)$$

$$= (m\times\hat{1}_t)\times\hat{T}_t\times\hat{T}_t\times\frac{d(\hat{T}_k{}^i\times v_i)}{dt} - \hat{1}_t \times \hat{T}_k{}^i \times F^{SA}{}_i =$$

$$= \hat{T}_t\times\hat{T}_k{}^i\times(m\times\frac{d\ v_i}{dt} - F^{SA}{}_i - F^{NSA}{}_i) = 0,\ F^{NSA}{}_i = \hat{T}_t\times\hat{1}_i{}^s\times\frac{d\hat{T}^r{}_s}{dt}$$

where: quantities with (without) a "hat" are defined on isotopic (conventional) spaces; and SA (NSA) stands for the verification (violation) of the conditions of variational selfadjointness for the existence of a potential [2f]. As one can see, isoequations (6.2.6) embed all nonpotential forces *in the differentials*, including all nonlocal effects outside the topology of Newton's equations. The new effects are now permitted by the new Santilli-Sourlas-Tsagas nonlocal isotopology [I-3e,23b].

B) The *isoaction principle* [I-3e] (where we assume hereon for simplicity $\hat{1}_t = 1$)

$$\delta\hat{A} = \delta\int_{t_1}^{t_2}(\hat{p}_k\times d\hat{r}^k - \hat{H}\times\hat{d}t) =$$
$$= \delta\int_{t_1}^{t_2}(p_i\times\hat{1}^i{}_j(t, r, p, ...)\times dr^j - H\times dt) = 0,$$
$$H = +p_k\hat{\times}_p p^k + V(t, r, p). \qquad (6.2.7)$$

C) The *Hamilton-Santilli isoequations* derivable from the above isoprinciple, first presented in [I-3e], p. 47,

$$\frac{dr^k}{dt} = \frac{\partial\hat{H}}{\partial\hat{p}_k} = \hat{1}^k{}_i(t, r, p)\times\frac{\partial H(t, r, p)}{\partial p_i},$$
$$\frac{dp_k}{dt} = -\frac{\partial\hat{H}}{\partial\hat{r}^k} = -\hat{T}_k{}^i(t, r, p)\times\frac{\partial H(t, r, p)}{\partial r^i}, \qquad (6.2.8)$$

which are directly universal for all possible isoequations (6.2.6)

D) The *Hamilton-Jacobi-Santilli isoequations*

$$\frac{\partial\hat{A}}{\partial t} + \hat{H} = 0, \qquad \frac{\partial\hat{A}}{\partial\hat{r}^k} = \hat{p}_k\ , \qquad \frac{\partial\hat{A}}{\partial\hat{p}_k} = 0 \qquad (6.2.9)$$

E) The algebraic form of the time evolution for an arbitrary quantity A(r,p) (see Equation (2.66) of [I-3e], p. 51)

$$\frac{dA}{dt} = [A\hat{,}H] = \frac{\partial A}{\partial r^k}\times\frac{\partial H}{\partial p_k} - \frac{\partial H}{\partial r^k}\times\frac{\partial A}{\partial p_k}\ , \qquad (6.2.10)$$

whose brackets $[A\hat{,}B]$ constitute a classical realization of the *Lie-Santilli isotheory* [I-3i to I-3l] here omitted for brevity jointly with the underlying *isoeuclidean and isosymplectic geometries* (see [I-3e]).

The resulting new mechanics is now called *Santilli's classical isomechanics* (see, *e.g.*, [I-3i to I-3l] and quoted literature). Its most important feature is that of being *invariant* under the most general possible *noncanonical* transformations $U\times\omega\times U^\dagger \neq \omega$, where ω is the symplectic two-form, provided that they are formulated via isomathematics (all products must be isotopic).

In fact, all transforms $U\times\omega\times U^\dagger \neq \omega$ can always be identically rewritten in the isocanonical form $\hat{U}\hat{\times}\hat{\omega}\hat{\times}\hat{U}^\dagger = \hat{\omega}$, where $\hat{\omega}$ is the *fundamental isosymplectic structure*, thus yielding the desired invariance. These notions require a knowledge of the isosymplectic geometry I cannot possibly review here (see memoir [I-3e] for brevity).

In this way I finally resolved in 1996 the fundamental inconsistency of the preceding Birkhoffian mechanics [2f], Hamilton-Admissible Mechanics [2i] and Hamilton-isotopic mechanics [I-3d].

The Hamilton-Santilli isomechanics is "directly universal" for all infinitely possible (well-behaved) reversible-isolated systems of particles verifying conventional total conservation laws, yet possessing: 1) internal forces which are of linear, local and potential type represented by the Hamiltonian $\hat{H} = p\hat{\times}p/2m + \hat{V}$; plus 2) nonlinear, nonlocal and nonpotential forces represented by isounits of the form

$$\hat{1} = \prod_{k=1,\ ...,N} \mathrm{Diag.}\ (n_{k1}{}^2, n_{k2}{}^2, n_{k3}{}^2)\times\Gamma_k(t, r, p, ...), \qquad (6.2.11)$$

where the diagonal term represents the shape of the individual particles, local densities along the space axes or other characteristics of the system at hand, while the Γ's represents their nonlinear, nonlocal, and nonpotential interactions. The isorepresentation occurs, by construction, directly in the frame of the observer (direct universality).

For more general shapes, the diagonal realization is lost in favor of (real-valued, symmetric and positive-definite) nondiagonal forms. Countless explicit models can be worked out according to the specific case at hand (see the quoted literature for various examples).

It is easy to see that, despite the presence of nonpotential internal forces, the total energy is trivially conserved because $\partial\hat{H}/\partial\hat{t} = 0$, and a similar case occurs for the other conservation laws.

Note the crucial role played by the isoderivative, first, to represent all nonhamiltonian effects and, second, to permit the abstract identity between the conventional and isohamiltonian mechanics. In fact, at the abstract, realization-free level, all distinctions cease to exist between $\partial/\partial r$ and $\hat{\partial}/\hat{\partial}r$, etc. As a result, isohamiltonian equations (6.7) coincide at the abstract level with the conventional Hamiltonian form (one could remove the "hat" and use the *same* equations of conventional mechanics under a *new interpretation* of the various symbols). We evidently have the same abstract identity of the conventional and isotopic Newton's equation.

Note that *the classical isomechanics can be characterized by a "hidden" symmetry of the Poisson brackets*, Equations (6.10), the identity $[A\hat{,}B] = [A, B]$, or *a "hidden symmetry" of the basic Euclidean invariant*, first introduced in memoir [I-3d]

$$r^2 = (r^i\times\delta_{ij}\times r^j)\times 1 = [r^i\times(n^{-2}\times\delta_{ij})\times r^j]\times(n^2\times 1) = (r^i\times\delta_{ij}\times r^j)\times\hat{1} = r^{\hat{2}} \qquad (6.2.12)$$

One should not be surprised that the above new invariance has remained unknown since Euclid's times, because its identification required the prior discovery of *new numbers*, those with arbitrary units [I-3h].

The reader should finally be aware that, for the construction of the classical isomechanics, I first constructed *the isotopies of Galilei's symmetry and relativity* [25], and proved the local

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isomorphism of the conventional and isotopic formulations. Regrettably, I cannot possibly review these studies in a short space.

A fundamental feature of the direct universality of classical isomechanics is that it occurs in the frame of the observers. This is important because of other deceptions in contemporary physics, which are inherent in transforming nonhamiltonian systems of our physical reality into Hamiltonian ones via the use of the celebrated *Darboux's transforms* $r \to r'(r, p)$, $p \to p'(r, p)$. After regaining a Hamiltonian structure (which is possible only for analytic and local-differential systems), orthodox physicists then claim to have "recovered" the beloved Einsteinian doctrines, or that the violation in the nonhamiltonian form was only "apparent."

The point is that Darboux's transforms are highly *nonlinear*. The first deception, generally perpetrated intentionally when proffered by experts, is that Darboux's transforms map the original inertial reference frame into highly noninertial ones, with consequential total collapse of the beloved Einsteinian doctrines. The second deception is that the transformed frames have a pure and sole *mathematical* meaning, evidently because one cannot possibly conduct measurements in transformed coordinates, say, of the type $r' = A(r,p) \times \mathrm{Exp}[B(r,p)]$.

The necessity of using actual variables r and p as occurring in the physical reality is necessary to avoid additional deceptions, this time at the operator level, which consist of claims to have recovered the beloved quantum mechanics for nonhamiltonian systems in mathematical coordinates $r'(r, p)$ and $p'(r, p)$ which have no physical meaning whatever.

In view of these insidious deceptions in the specialized literature, *the entire analysis of this paper will be restricted to the sole use of variables r and p = m×v as occurring in the physical reality of the observer.*

In conclusion, the classical isomechanics outlined above provides an invariant description of closed-isolated systems verifying conventional conservation laws, yet having new nonhamiltonian internal effects. As we shall see in subsequent papers, the latter *new* effects are directly relevant for the prediction, treatment, and optimization of *new* energies.

6.3. Nonrelativistic Isoquantization

Once the above classical foundations are understood, the transition to the operator isomechanics is straightforward. Recall that the naive quantization $A \to i \times \hbar \times \ln|\psi(t, r)$ maps the *conventional* canonical action A into Schrödinger's equations. The symplectic quantization is a more rigorous map of classical into quantum formulations, essentially yielding the same results.

It is evident that the conventional quantization is *inapplicable* to classical isomechanics and requires an isotopic lifting into a form applicable to the isoaction (6.6).

This yields the *unique and unambiguous* map of the classical into the operator isomechanics called *isoquantization*, first studied by A. O. E. Animalu, E. B. Lin and R. M. Santilli (see [1-3c] for details and references) which, in its simplest form, is expressed via the map of Equations (6.2.9) (where we here assume $\hbar = 1$ and $\hat{1}$ independent from t and r, but dependent on p and $\hat{\psi}$; see [1-3c] for the general case)

$$\begin{aligned}
\hat{A} &\to i \times \hat{1} \times \ln|\hat{\psi}(t, \hat{r})>, \\
\partial\hat{A} / \partial\hat{t} + \hat{H} = 0 &\to i\,\hat{1}\times(\partial\hat{\psi}/\partial\hat{t}) / \hat{\psi} + \hat{H} = 0 \\
\partial\hat{A} / \partial\hat{r}^k - \hat{p}_k = 0 &\to i\,\hat{1}\times(\partial\hat{\psi}/\partial\hat{r}^k) / \hat{\psi} - \hat{p}_k = 0, \\
\partial\hat{A} / \partial\hat{p}_k = 0 &\to i\,\hat{1}\times(\partial\hat{\psi}/\partial\hat{p}_k / \hat{\psi}) = 0. \qquad (6.3.1)
\end{aligned}$$

All other aspects of the operator mechanics can then be constructed via mere compatibility arguments. The more rigorous *isosymplectic quantization* essentially yields the same results.

6.4. Nonrelativistic Isomechanics

The fundamental equations of the isotopic branch of nonrelativistic hadronic mechanics are:

1) *The isoschroedinger equations*, first reached in a noninvariant form by R. Mignani, H. C. Myung and R. M. Santilli in 1981-1982 (see [1-3c] for references) and first reached in the following invariant form via the isodifferential calculus by Santilli in Ref. [1-3d], p. 675. Via a simple reformulation of Equations (6.3.1), they can be written

$$\begin{aligned}
i\,\partial_t|\,\hat{\psi}> &= i\,\hat{T}_t \times \partial_t\,|\,\hat{\psi}> = \hat{H} \hat{\times} |\,\hat{\psi}> = \\
&= \hat{H} \times \hat{T} \times |\,\hat{\psi}> = \hat{E} \times \hat{T} \times |\,\hat{\psi}> = (E \times \hat{1}) \times \hat{T} \times |\,\hat{\psi}> = E \times |\,\hat{\psi}>, \\
\hat{p}_k \hat{\times} |\,\hat{\psi}> &= \hat{p}_k \times \hat{T} \times |\,\hat{\psi}> = -i\,\partial_k|\,\hat{\psi}> = -i\,\hat{T}_k{}^i \times \partial_j|\,\hat{\psi}>, \qquad (6.4.1)
\end{aligned}$$

where: quantities with (without) a "hat" are represented on isospaces over isofields (conventional spaces over conventional fields); $\hat{e}$ is the isoexponentiation,

$$\begin{aligned}
\hat{e}^X &= \hat{1} + X/1\,! + X\hat{\times}X/2\,! + \ldots = [\exp(X \times \hat{T})] \times \hat{1} = \\
&= \hat{1} \times [\exp(\hat{T} \times \hat{A})]; \qquad (6.4.2)
\end{aligned}$$

$|\,\hat{\psi}> = |\,\hat{\psi}(t, r)>$ are *isostates* defined on an *isohilbert space* $\hat{\mathcal{H}}$ with *isoinner product*

$$<\hat{\phi}\,|\times\hat{T}\times|\,\hat{\psi}> \times \hat{1} = (\int dr^3\,\hat{\phi}\dagger\times\hat{T}\times\hat{\psi})\times\hat{1}, \qquad (6.4.3)$$

over the isofield $\hat{C}$ of isocomplex numbers $\hat{c} = c \times \hat{1}$; and *isoexpectation values* are given by

$$<\hat{A}> = \frac{<\hat{\phi}\,|\times\hat{T}\times A\times\hat{T}\times|\,\hat{\psi}>}{<\hat{\phi}\,|\times\hat{T}\times|\,\hat{\psi}>} \qquad (6.4.5)$$

One should note that all isoscrödinger equations prior to their formulation via the isodifferential calculus in memoir [1-3d] are noninvariant and, thus, physically meaningless.

2) *The isoheisenberg equations*, first submitted by Santilli in [2d], Equations (4.4) in noninvariant form, and then formulated in their invariant form via the isodifferential calculus in memoir [1-3d], p. 675,

$$\begin{aligned}
\hat{A}(t) &= \hat{U} \times' \hat{A}(0) \times' \hat{U}^{\hat{\dagger}} = \hat{e}^{i\hat{H}\times t} \hat{\times} \hat{A}(0) \hat{\times} \hat{e}^{-i\,t\times\hat{H}} = \\
&= e^{i\hat{H}\times\hat{T}\times t} \times \hat{A}(0) \times e^{-it\times\hat{T}\times\hat{H}}, \\
i\,d\hat{A} / dt &= i\,\hat{T}_t \times dA / dt = [\hat{A} \hat{,}' \hat{H}] = \\
&= \hat{A} \hat{\times} \hat{H} - \hat{H} \hat{\times} \hat{A} = \hat{A} \times \hat{T} \times \hat{H} - \hat{H} \times \hat{T} \times \hat{A}, \\
[\hat{r}^s \hat{,}' \hat{p}_j] \hat{\times} |\,\hat{\psi}> &= \delta^s{}_j \hat{\times} |\,\hat{\psi}> = \delta^i{}_j \times |\,\hat{\psi}>, \\
[\hat{r}^i \hat{,}' \hat{r}^j] \hat{\times} |\,\hat{\psi}> &= [\hat{p}_i \hat{,}' \hat{p}_j] \hat{\times} |\,\hat{\psi}> = 0, \qquad (6.4.6)
\end{aligned}$$

The most salient property of the above isotopic laws is that they provide a *new realization* of Lie's axioms which is *invariant* under the most general possible transformations, including the invariance under the time evolution of the theory itself, *provided* that the transformations are written in the appropriate isomathematics. This invariance was lacking for Equations (4.3), see noninvariance (4.5).

In fact, the most general possible nonlinear, nonlocal and nonunitary transforms can always be *identically* rewritten in the *isounitary form*, first introduced by R. M. Santilli in [1-3d]

$$W \times W^\dagger = \hat{1} \neq I,\ W = \hat{W} \times \hat{T}^{1/2},\ W \times W^\dagger = \hat{W} \hat{\times} \hat{W}^{\hat{\dagger}} = \hat{W}^{\hat{\dagger}} \hat{\times} \hat{W} = \hat{1}. \quad (6.4.7)$$

The isotopic branch of hadronic mechanics is then invariant under the above isotransforms. This includes the invariance of the *numerical values* of the isounit, isotopic element, isoeigenvalues, etc., exactly as it occurs for quantum mechanics (Section 3),

$$\begin{aligned}
\hat{1} &\to \hat{1}' = \hat{W} \times' \hat{1} \times' \hat{W}^{\hat{\dagger}} = \hat{1}, \\
\hat{A} \times' \hat{B} &\to \hat{W} \times' (\hat{A} \hat{\times} \hat{B}) \hat{\times} \hat{W}\dagger = \hat{A}' \times \hat{T} \times \hat{B}' = \hat{A}' \hat{\times} \hat{B}', \\
\hat{W} &\times' (\hat{A} \times' \hat{B} - \hat{B} \times' \hat{A}) \times' \hat{W}^{\hat{\dagger}} = \hat{A}' \hat{\times} \hat{B}' - \hat{B}' \hat{\times} \hat{A}',
\end{aligned}$$

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$$\hat{A}\hat{\times}|\hat{\psi}\rangle = \hat{E}\hat{\times}|\hat{\psi}\rangle \rightarrow \hat{W}\hat{\times}\hat{A}\hat{\times}|\hat{\psi}\rangle = \hat{A}\hat{\times}|\hat{\psi}'\rangle = \hat{E}\hat{\times}|\hat{\psi}\rangle, \hat{E}' = \hat{E}. \quad (6.4.8)$$

In short, the isoproduct is changed under conventional transforms as in Equation (4.5), $\hat{x} \rightarrow \hat{x}' \neq \hat{x}$, thus implying noninvariance, while it is left unchanged by the isotransforms, $\hat{x} \rightarrow \hat{x}' = \hat{x}$, thus yielding invariance.

The equivalence of the isoschrödinger and isoheisenberg equations can then be easily proved via isounitary transforms (see [1-3c] for details).

It is instructive for the interested reader to prove that time evolution (6.4.1) is itself an isounitary transform. The theory is, therefore, invariant under its own time evolution, as necessary for physical consistency.

The invariance of the isochrödinger and isoheisenberg equations is then completed by the necessary use of the isodifferential calculus in the partial and total isoderivatives $\partial/\partial\hat{t}$, $\hat{d}/\hat{d}t$, $\partial/\partial\hat{x}^k$, etc., which are now invariant because their basic unit is invariant.

Note that conventional derivatives *cannot* lead to invariant dynamical equations because they are based on conventional numbers whose basic unit is no longer the unit of the theory, thus leading to a host of inconsistencies.

The above invariances, achieved for the first time in memoir [1-3d] of 1997, finally permitted consistent physical applications and verification of hadronic mechanics (outlined in Paper III) that had not been possible since the original proposal of the theory back in 1978.

A system is characterized in quantum mechanics via the sole assignment of the Hamiltonian with the tacit assumption of the simplest possible unit + 1. A system is characterized in hadronic mechanics via the assignment of the Hamiltonian for action-at-a-distance, potential interactions and the explicit form of the isounit for the additional contact nonhamiltonian interactions.

Note that *changing the unit or the isounit implies the transition to a different system.* For this reason quantum mechanics solely allows transformations such that $U \times U^\dagger = \hat{U}^\dagger \times U = 1$ *with* 1 *fixed.* For exactly the same reason, hadronic mechanics solely allows isotransforms $\hat{U}\hat{\times}\hat{U}^\dagger = \hat{U}^\dagger\hat{\times}\hat{U} = \hat{1}$ *with* $\hat{1}$ *fixed for the system at hand.*

It is easy to prove that *all quantities that are Hermitean-observables in quantum mechanics remain so in (operator) isomechanics* because the conditions of Hermiticity and isohermiticity coincide. In fact, the use of a isohilbert, rather than a Hilbert space (that is, the use of the isoproduct $H\hat{\times}|\ \rangle$ rather than the conventional product $H \times |\ \rangle$), implies the transition from condition (4.6) to the form, first proved by H. C. Myung and R. M. Santilli in 1981 [1-3c],

$$(\langle\hat{\psi}| \times T \times \hat{A}^\dagger) \times \hat{T} \times |\hat{\psi}\rangle = \langle\hat{\psi}| \times \hat{T} \times (\hat{A} \times T \times |\hat{\psi}\rangle),$$
$$\hat{A}^\dagger = T \times T^{-1} \times \hat{A} \times T \times T^{-1} = H^\dagger \quad (6.4.9)$$

It is also easy to prove that, under sufficient topological conditions here ignored for simplicity, *all isohermitean operators admit isoreal isoeigenvalues, i.e.,* for $\hat{A}^\dagger = \hat{A}$ we have Equation (6.3.2) where E is an ordinary real number.

The important point is that *isomechanics preserves all conventional observables, all observables remain so under the time evolution of the theory, and all numbers predicted by the theory are unique, invariant and conventional.*

The above results are sufficient to indicate that *all features of quantum mechanics admit a unique and consistent image in isomechanics,* thus including causality, probability, etc. These additional aspects are not reviewed here for brevity (see [1-3c,1-3d]).

Next, it is important to see that *isomechanics preserves all conventional quantum laws and principles,* although derived from a broader formalism.

The preservation of Heisenberg's uncertainties can be inferred via the mere inspection of the preservation of the conventional eigenvalues δ_{ij} in the fundamental (r, p)- isocommutators of Equations (6.4.5). In fact, we have the *isotopic uncertainties* (for $\hbar = 1$), first proved by R. M. Santilli [1-3d],

$$\hat{\Delta}r \times \hat{\Delta}p \geq \hat{\hbar} \langle\hat{\psi}|\hat{\times}(r \hat{\times} p)\hat{\times}|\hat{\psi}\rangle = \hat{\hbar} \quad (6.4.10)$$

where now, by central assumption, r and p are the actual, physical coordinates and momenta of the observer beginning at the classical level (rather than deceptive mathematical algorithms without physical meaning). The preservation of Pauli's exclusion principle is established by the preservation of the spin $\hat{\hbar}$ under isotopies (see [1-5c] for brevity). The same holds for all other quantum laws and principles.

The above results disprove several claims in the literature of "violation" of Heisenberg's uncertainties, *e.g.,* the claims by the so-called "squeezed states theories." In fact, *all* the latter theories admit an *identical* reformulation in terms of isoequations (6.4.5) which reconstruct the validity of the *conventional* uncertainties on isohilbert spaces over isofields for closed-isolated systems (see [1-3c] for details).

By no means is the isotopic preservation of conventional principles, trivial, because it implies their validity under the most general known nonlinear, nonlocal and nonpotential interactions.

Recall that the Hamilton-Santilli isomechanics is directly universal for all possible, classical (well-behaved), closed-isolated systems with Hamiltonian and nonhamiltonian internal forces.

It is easy to see that the operator image is also directly universal. In fact, we have the following:

THEOREM 6.1: The isochrödinger and isoheisenberg equations are directly universal for all possible closed-isolated systems verifying conventional total conservation laws, yet admitting linear and nonlinear, local, and nonlocal and potential or nonpotential internal interactions.

The verification of conventional total conservation laws follows from the antisymmetric character of the Lie-Santilli isobrackets $[A, \hat{\times} B] = A\hat{\times}B - B\hat{\times}A$ (as well as, more technically, from the preservation of conventional generators in the spacetime isosymmetries [25]). The admission of all possible nonhamiltonian effects is established by the arbitrariness of the isounit $\hat{1}$.

The direct universality can be illustrated via the *identical* reformulation of conventional nonlinear equations [17] $H(r, p, \psi) \times \psi = H_0(r, p) \times \hat{T}(\psi, \ldots) \times \psi = E \times \psi$ (*i.e.,* with the embedding of all nonlinear terms in the isotopic elements). This reformulation permits the recovering of the superposition principle, as one can verify, as well as the resolution of the other inconsistencies of the conventional nonlinear theories. Similar resolutions hold for all known inconsistent theories [2-14] (see [16] for brevity).

An important property of isomechanics is that of turning any divergent quantum series into a convergent form under the sole assumption of a sufficiently small absolute value of the isotopic element, $|\hat{T}| < 1$. This can be seen from the following divergent canonical series which is turned into a convergent isocanonical form, first studied by R. Mignani, A. Jannussis and R. M. Santilli (see [1-3c] for a detailed presentation of the isoperturbation theory and related references)

$$A(k) = A(0) + k[A, H]/1! + \ldots \rightarrow \infty, k > 1,$$
$$A(k) = A(0) + k[A, \hat{\times} H]/1! + \ldots = N < \infty, \hat{T} = k^{-n} \quad (6.4.11)$$

As a consequence, any series in physics or chemistry which is divergent (such as those for strong interactions) or slowly convergent (such as the Gaussian lobe expansions in quantum chemistry), can be turned by the isotopies into a convergent or much faster convergent form, respectively, via the sole judicious selection of the isounit.

We finally note that *isomechanics is not a "new theory"* because it is based on exactly the same abstract axioms of quantum mechanics, and merely provides a "new realization" of

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quantum axioms and physical laws.

The above occurrence can be best seen by noting that *quantum and isomechanics coincide at the abstract, realization-free level* in which all distinctions cease to exist between I and $\hat{I}$, $A \times B$ and $A \hat{\times} B$, $\mathcal{H}$ and $\hat{\mathcal{H}}$, etc.

The ultimate abstract unity of quantum and isomechanics can be best seen as follows. The central difference between the two mechanics is given by the lifting of the basic unit $I \to \hat{I}$, $\hat{I} = \hat{I}^\dagger > 0$. It is then easy to see that $\hat{I}$ preserves all properties of I, first identified by R. M. Santilli in [1-3h],

$$I > 0 \;\to\; \hat{I} > 0\,,$$

$$I^n = I \times I \times \ldots \times I = I \;\to\; \hat{I}^{\hat{n}} = \hat{I} \hat{\times} \hat{I} \hat{\times} \ldots \hat{\times} \hat{I} = \hat{I}\,,$$

$$I / I = I \;\to\; \hat{I} \hat{/} \hat{I} = \hat{I}\,,$$

$$I \times |\psi\rangle = |\psi\rangle \;\to\; \hat{I} \hat{\times} |\psi\rangle = |\psi\rangle,$$

$$i\, dI / dt = I \times H - H \times I = 0 \;\to\; i\, d\hat{I} / dt = \hat{I} \hat{\times} \hat{H} - \hat{H} \hat{\times} \hat{I} = 0,$$

$$\langle I \rangle = \frac{\langle \psi | \times I \times | \psi \rangle}{\langle \psi | \times | \psi \rangle} I \to \langle \hat{I} \rangle^{\hat{}} = \frac{\langle \hat{\psi} | \hat{\times} \hat{I} \hat{\times} | \hat{\psi} \rangle}{\langle \hat{\psi} | \hat{\times} | \hat{\psi} \rangle} = I \qquad (6.4.12)$$

The two units then coincide at the abstract level, by implying the abstract identity of all formulations built on them.

Note in the last expression that *the isoexpectation values of the isounit produce the conventional unit value* I. By remembering that the unit of quantum mechanics is Planck's unit $\hbar = I$, this means that isomechanics lifts Planck's *constant* $\hbar$ into a *local integro-differential operator* $\hat{\hbar} = \hat{I}$ in such a way that its isoexpectation values recover the conventional numerical value $\hbar$.

Despite the above abstract identity, the reader should be aware that quantum and isomechanics are physically inequivalent, because they are connected by a nonunitary transform and admit *different eigenvalues for the same Hamiltonian operator*, $H \times | \rangle = E \times | \rangle$, $H \times \hat{T} \times | \rangle = E' \times | \rangle$, $E' \neq E$.

Also, hadronic mechanics has provided in 1978 the first explicit and concrete realization of hidden variables λ, $H \hat{\times} |\psi\rangle = H \times \lambda \times |\psi\rangle = E \times |\psi\rangle$, $\lambda = \hat{T}$ (see [1-5c] for a detailed analysis).

An effective way to introduce hadronic mechanics is by noting that it is the outcome of the *novel degrees of freedom of Euclid's axioms*, Equation (6.2.12), plus the *novel degree of freedom of Hilbert's axioms* (here expressed for a matrix $\hat{I} = I/\hat{T}$ independent from the integration variable), first introduced in [1-3d],

$$\langle \phi | \times | \psi \rangle \times I = \langle \phi | \times \hat{T} \times | \psi \rangle \times \hat{I}\,. \qquad (6.4.13)$$

The above invariance assures that all physical laws valid for theories formulated on conventional spaces and fields also hold for theories formulated on broader isospaces over isofields.

The fact that the new invariance (6.4.12) has remained unknown since Hilbert's time should not be surprising because its identification required the prior discovery of *new numbers*, those with *arbitrary units*.

In conclusion, the operator isomechanics permits quantitative treatments of a *new conception of isolated bound states of particles*, those verifying conventional total conservation laws, yet admitting novel nonhamiltonian internal effects. These systems are the unique and unambiguous operator counterpart of the corresponding generalized classical systems of Section 6.2.

The *new* operator effects will then permit in subsequent paper the prediction, treatment and optimization of *new* energies at the operator level. In this way the *new* energies as per Definition 1.1.2.1 are equipped for the first time with a rigorous, diversified, interconnected, and invariant classical and operator theory. ID

6.5. Relativistic Isomechanics

As is well known, relativistic theories are based on the Minkowskian spacetime $M(x,\eta,R)$ with local coordinates $x = (x^\mu) = (ct, t)$, $c_0 = 1$, $\mu = 1, 2, 3, 4$, $k = 1, 2, 3$, metric $\eta = \mathrm{Diag.}\,(1, 1, 1, -1)$, and interval $(x - y)^2 = (x-y)^\mu \times \eta_{\mu\nu} \times (x-y)^\nu$ defined on the field of real numbers $R(n,+,\times)$.

Relativistic isomechanics is based on the isotopies of the Minkowskian space, which were first introduced by the author in 1985 [25a] and in various subsequent papers [25], and are today called *Minkowski-Santilli isospaces* see [23a,1-3i to 1-3j] for independent reviews. They have the structure $\hat{M} = \hat{M}(\hat{x},\hat{\eta},\hat{R})$ with: isocoordinates $\hat{x} = x \times \hat{I}$; isometric $\hat{\eta} = (\hat{\eta}_{\mu\nu} \times \hat{I}$, $\hat{\eta} = (\hat{\eta}_{\mu\nu}) = \hat{T}(x, v, \phi, \partial\phi, \ldots) \times \eta$, where the isotopic element $\hat{T}$ is now a nowhere singular, Hermitean and positive-definite 4×4 matrix which, as such, can always be diagonalized to the form $\hat{T} = \mathrm{Diag.}\,(\hat{T}_{11}, \hat{T}_{22}, \hat{T}_{33}, \hat{T}_{44})$.

The fundamental interval of the theory is the isoinvariant on $\hat{M}$ over the isofield $\hat{R}(\hat{n},+,\hat{\times})$ with the same isounit $\hat{I} = I/\hat{T}$

$$\begin{aligned}(\hat{x} - \hat{y})^{\hat{2}} &= (x - y)^\mu \times \hat{I} \times \hat{T} \times \eta_{\mu\nu} \times \hat{I} \times \hat{T} \times (x - y)^\nu \times \hat{I} = \\ &= [\,(x - y)^\mu \times \hat{\eta}_{\mu\nu}(x, v, \phi, \partial\phi, \ldots) \times (x - y)^\nu\,] \times \hat{I} = \\ &= [\,(x - y)^1 \times \hat{T}_{11} \times (x - y)^1 + (x - y)^2 \times \hat{T}_{22} \times (x - y)^2 + \\ &+ (x - y)^3 \times \hat{T}_{33} \times (x - y)^3 - (x - y)^4 \times \hat{T}_{44} \times (x - y)^4\,] \times \hat{I} \in \hat{R}. \end{aligned} \qquad (6.5.1)$$

It is easy to see that the joint lifting $\eta \to \hat{\eta} = \hat{T} \times \eta$ and $I \to \hat{I} = I/\hat{T}$ preserves all the original geometric axioms of M. The spaces M and $\hat{M}$ are therefore locally isomorphic and the lifting $M \to \hat{M}$ is an isotopy.

The basic invariance of conventional relativistic theories is the celebrated Poincaré symmetry of interval $(x-y)^2$. The corresponding symmetry of the isospacetime was first studied in [25], and is today called *Poincaré-Santilli's isosymmetry* [1-3h,1-3i,23,24]. It consists of the most general possible isolinear, isolocal and isocanonical invariant of isoseparation (6.5.1). Its main components are:

1) The *isorotational symmetry*, first presented in [25b] which, for the case of isorotations in the x-y axes, can be written

$$\hat{x}' = \hat{x} \times \cos(\hat{T}_{11}^{\hat{-}1} \times \hat{T}_{22}^{\hat{-}1} \times \theta_3) - \hat{y} \times \hat{T}_{11}^{-1} \times \hat{T}_{22}^{-1} \times \sin(\hat{T}_{11}^{\hat{-}1} \times \hat{T}_{22}^{\hat{-}1} \times \theta_3)\,,$$

$$\hat{y}' = \hat{x} \times \hat{T}_{11}^{-1} \times \hat{T}_{22}^{-1} \times \sin(\hat{T}_{11}^{\hat{-}1} \times \hat{T}_{22}^{\hat{-}1} \times \theta_3) + \hat{y} \times \cos(\hat{T}_{11}^{\hat{-}1} \times \hat{T}_{22}^{\hat{-}1} \times \theta_3)\,, \qquad (6.5.2)$$

with corresponding symmetries in three dimensions [1-3c].

2) The *Lorentz-Santilli isosymmetry*, first submitted in [25a], which includes the isorotations plus the isoboosts in the $\hat{x}$-$\hat{t}$ planwe

$$\begin{aligned}\hat{x}^3 &= \hat{x}^3 \times \sinh(\hat{T}_{33}^{\hat{-}1} \times \hat{T}_{44}^{\hat{-}1} \times v) - \hat{x}^4 \times \hat{T}_{33}^{-1} \times \hat{T}_{44}^{-1} \times \cosh(\hat{T}_{33}^{\hat{-}1} \times \hat{T}_{44}^{\hat{-}1} \times v) \\ &= \hat{\gamma} \times (\hat{x}^3 - \hat{T}_{33}^{-1} \times \hat{T}_{44}^{-1} \times \beta \times \hat{x}^4)\,, \\ \hat{x}^4 &= -\hat{x}^3 \times \hat{T}_{33}^{-1} \times c_0 - 1 \times \hat{T}_{44}^{-1} \times \sinh(\hat{T}_{33}^{\hat{-}1} \times \hat{T}_{44}^{\hat{-}1} \times v) + \\ &+ \hat{x}^4 \times \cosh(\hat{T}_{33}^{\hat{-}1} \times \hat{T}_{44}^{\hat{-}1} \times v) = \gamma\, \hat{x}(\hat{x}^4 - \hat{T}_{33}^{-1} \times \hat{T}_{44}^{-1} \times \beta \times \hat{x}3)\,, \\ \beta &= v_k \times \hat{T}_{kk}^{-1} / c_0 \times \hat{T}_{44}^{-1}\,, \quad \hat{\gamma} = (1 - \hat{\beta}^2)^{-1/2}. \end{aligned} \qquad (6.5.3)$$

as well as the isotopies of the SU(2)-spin symmetry first presented in [25c,25d], here omitted for brevity;

3) The *isotranslations*, first presented in [25e]

$$\hat{x}' = (\hat{e}^{i\hat{p} \times a}) \hat{\times} \hat{x} = \hat{x} + a \times A(x, \ldots), \qquad \hat{p}' = (\hat{e}^{i\hat{p} \times a}) \hat{\times} \hat{p} = \hat{p},$$

$$A_\mu = \hat{T}_{\mu\mu} 1/2 + a^\alpha \times (\hat{T}_{\mu\mu} 1/2)^{\hat{}} \hat{p}_\alpha]/1! + \ldots. \qquad (6.5.4)$$

4) The *space and time isoinversions*, first presented in [25a]

$$x' = \hat{\pi} \hat{\times} \hat{x} = (-\hat{r}, \hat{t}), \qquad \hat{x}' = \hat{\tau} \hat{\times} \hat{x} = (\hat{r}, -\hat{t}), \qquad (6.5.5)$$

5) The novel *isoscalar symmetry*, first introduced in [1-3d],

$$\hat{\eta} = \hat{T} \times \eta \;\to\; \hat{\eta}' = \hat{T}' \times \eta, \hat{I} = I/\hat{T} \;\to\; \hat{I}' = n \times \hat{I},\ n \in R. \qquad (6.5.6)$$

The verification that the above isosymmetries do in fact leave invariant isointerval (6.5.1) is instructive. It shows that the Poincaré-Santilli isoinvariance holds for all infinitely possible, well-behaved, real-valued, nowhere singular and symmetric

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isometrics $\hat{\eta}$ irrespective of their explicit functional dependence, which can therefore be selected for the specific case at hand (Section II.7 and Paper III).

While the Poincaré symmetry has *ten* dimensions, the Poincaré–Santilli isosymmetry has *eleven* dimensions. As we shall see, the added *new* dimension is crucial for the prediction of *new* energies as well as for several other *new* applications.

In addition to the above isosymmetries we finally have the *spinorial covering of the Poincaré–Santilli isosymmetry* first presented in [25f] which is here omitted for brevity. The nonrelativistic image, the *Galilei–Santilli isosymmetry*, has been studied in detail in volumes [25h,25i] and its review will also be omitted for brevity.

The isominkowskian spaces and symmetries and their underlying methods permit the easy construction of the isotopies of any needed, classical and operator relativistic formulations. As an example, we quote here the *second-order isorelativistic equation*

$$(\hat{N}^{\rho\sigma} \hat{\times} \hat{p}_\rho \hat{\times} \hat{p}_\sigma + \hat{m}^2) \hat{\times} \hat{\psi} = 0, \qquad (6.5.6)$$

its linearized form called the *Dirac–Santilli isoequation*,

$$(\hat{N}^{\mu\nu} \hat{\times} \hat{\gamma}_\mu \hat{\times}^{Spin} \hat{p}_\nu - i \times \hat{m}) \hat{\times}_{orb} \hat{\psi} =$$
$$= (\hat{\eta}^{\mu\nu} \times \hat{\gamma}_\mu \times \hat{T}^{Spin} \times \hat{p}_\nu \times \hat{T}^{Orb} - i \times m) \times \hat{\psi} = 0, \qquad (6.5.7)$$

where the *isogamma matrices* are defined by

$$(\hat{\gamma}_\mu \hat{,} \hat{\gamma}_\alpha) = \hat{\gamma}_\mu \times \hat{T}^{spin} \times \hat{\gamma}_\alpha \times \hat{T}^{Spin} +$$
$$+ \hat{\gamma}_\alpha \times \hat{T}^{Spin} \times \hat{\gamma}_\mu \times \hat{T}^{Spin} = 2 \times \hat{\eta}_{\mu\alpha}, \qquad (6.5.8)$$

and admit the explicit realization

$$\hat{\gamma}_\mu = (\hat{T}_{\mu\mu}^{Orb})^{1/2} \times U^{Spin} \times \gamma_\mu \times U^{\dagger\, Spin} \times \hat{T}^{spin},$$

$$\hat{\gamma}_k = (\hat{T}_{kk}^{Orb})^{1/2} \times \gamma_k \times \hat{T}^{Spin} = \hat{T}_{kk}^{1/2} \begin{pmatrix} 0 & \hat{\sigma}_k \\ \hat{\sigma}^d_k & 0 \end{pmatrix} \times \hat{T}^{Spin}$$

$$\gamma_4 = (\hat{T}_{44}^{Orb})^{1/2} \times \gamma_4 \times \hat{T}^{Spin} = (\hat{T}_{kk}^{Orb})^{1/2} \times \begin{pmatrix} I^{Spin}_{2\times2} & 0 \\ 0 & I^{d\,Spin}_{2\times2} \end{pmatrix} \times \hat{T}^{Spin}$$

$$\hat{\sigma}_k = W \times \sigma_k \times W^\dagger, \quad \hat{\sigma}^d_k = -\hat{\sigma}^\dagger_k = -W^\dagger \times \sigma_k \times W, \qquad (6.5.9)$$

with W being an arbitrary 2×2-dimensional *nonunitary* transform and "d" representing isoduality.

As one can see, Equation (6.5.7) is fully symmetric for particles and antiparticles, the former defined on isospaces over isofields and the latter defined on their isodual. Equation (6.5.7) also admits as a particular case a similar fully symmetrized version of the conventional Dirac equation for $\hat{1}_{\mathbb{Z}} = 1_{\mathbb{Z}}$.

As such, Equation (6.5.7) permits, for the first time, *a description of antiparticles at the level of first quantization* (the current description only holds for the *second* quantization). This should not be surprising because isodualities permit a characterization of antimatter which begins at the *Newtonian* level, and then continues at all subsequent levels, including second quantization where it becomes equivalent to charge conjugation [I-3g].

As we shall see, the above isorelativistic equations play a fundamental role in the applications and experimental verification of hadronic mechanic, particularly those for new energies.

6.6 Geno- and Hyper-mechanics

The broader classical and operator genomechanics for open-nonconservative systems [I-3d] are characterized by the relaxation of the symmetric character of the isounit and the use of general Lie-admissible equations (4.3) [2d] with corresponding classical counterparts [2f]. The formulation of Equations (4.3) via the genomathematics of Section 5 then permits the achievement of invariance as in the isotopic case (see [I-3d] for brevity).

A most salient feature of classical genomechanics is that of providing the first known invariant formulation of the historical Lagrange's and Hamilton's equations, those *with external terms*.

A salient aspect of operator genomechanics is that of permitting for the first time the *identification of the origin of irreversibility in the ultimate levels of nature, those of elementary particles in interior conditions*, such as an electron in the core of a star.

The broader classical and operator hypermechanics [I-3e] are characterized by the relaxation of the single-valuedness of the genounits as per the hypermathematics of Section 5.

A rather direct way of seeing the inevitability of the genotopic and hyperstructural formulations is by inspecting the fundamental novel invariants (6.2.12) for the Euclidean axioms and (6.4.12) for Hilbert's axioms. It is easy to see that these invariances also hold for nonsymmetric as well as multivalued structures. Therefore, all properties of quantum mechanics must necessarily admit a genotopic and hyperstructural expansion as consistent as the conventional theory.

For details on the geno- and hypermechanics, I refer the interested reader to monograph [I-3e,I-3d,I-3f]. We shall use genomechanics whenever considering new energies under open-nonconservative conditions. Hypermechanics will be used only when necessary due to their complexity.

7. ISO-, GENO-, HYPER-RELATIVITIES AND COSMOLOGIES

As stressed in Paper I (Section I.3), special relativity is, by far, the most insidious obstacle for new energies. It is an easy prediction that no quantitative scientific study on new energies is possible without an identification of the limitations of special relativity (done in Paper I) and the construction of suitable covering relativities for broader physical conditions (outlined in this section).

I have learned since the early days of my graduate studies that physics admits the reduction of all events to primitive relativity laws. I, therefore, dedicated my research life to the search for an invariant generalization of special relativity because, whether in energy or other fields, there cannot be truly "new" basic advances in physics without covering relativities.

Special relativity was constructed by Lorentz, Poincaré, Einstein, Minkowski and others for the *invariant formulation of the speed of light in vacuum* c_0 (the literature accumulated in the field is so vast as to prevent discriminatory partial listings).

However, the contemporary notion of "universal constancy of the speed of light" is a purely philosophical (or political) abstraction because, in the physical reality, *light has a local speed* $c = c_0/n(\mu, \tau, \ldots)$, that is, a speed depending on the local physical conditions of density μ, temperature τ, etc., of the medium in which it propagates. This dependence is generally represented by the familiar index of refraction n.

This occurrence is well-known since the discovery of the refraction of light as in the apparent bending of a straight stick when partially immersed in water. More generally, incontrovertible experimental evidence establishes that light has *different speeds* $c = c_0/n < c_0$ when propagating in different media of low density such as air, water, glass, oil, or other transparent substances. It has also been experimentally established nowadays that light has speeds $c = c_0/n > c_0$ when propagating in media of extreme densities, such as those in the interior of hadrons and stars (see Section I-3.2 of [I-13]).

It is evident that a relativity which has been constructed for the speed of light in vacuum with c_0 = constant, is *inapplicable* (and not "violated") for the arbitrary local speeds of the physical reality with $c = c_0/n(\mu, \tau, \ldots)$ = function.

Any attempt by orthodox and nonorthodox physicists alike of

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adapting physical reality to their beloved theory is faced with instant disqualification, or exiting science altogether, because of personal political gains. As an illustration, consider the *Cerenkov light* (the bluish light visible in the water pools of nuclear reactors) which is created by *ordinary electrons traveling faster than the speed of light* in water. If one assumes the speed of light as the maximal causal speed (as necessary for special relativity), the Cerenkov light would constitute evidence of the violation of the basic principle of causality (since ordinary physical particles would travel faster than the maximal causal speed).

The attempt to salvage the principle of causality by assuming the speed of light *in vacuum* as the maximal causal speed *in water*, immediately implies the violation of another pillar of special relativity, the relativistic composition law for speeds. Similar gross inconsistencies occur for other possible assumptions.

A mandatory condition not to exit science for personal gains is the open admission that the special relativity is inapplicable for interior dynamical problems implying propagation within physical media, contact zero-range effects and other interior conditions. The selection of the appropriate generalization is evidently open to scientific debates, but its' need should not be questioned.

All research I reported so far in these papers (as well as in the subsequent papers) was merely preparatory for the classical and operator generalization of the special relativity into *the isospecial relativity defined as an invariant formulation for arbitrary speeds of light as well as, more generally, for arbitrary interior systems, under the condition of recovering special relativity identically whenever motion returns to be in vacuum.*

The isotopies of special relativity have been studied in [25] with a comprehensive review in volumes [1-3b,1-3c]. The isotopies of Galilei's relativity have been studied in Volumes [25h,25i] and, for brevity, will not be considered here.

First, the task required the lifting of the mathematical foundations of special relativity reported in the preceding sections, plus the lifting of the Lie theory in all its branches (enveloping algebras, Lie algebras, Lie groups, Lie symmetries, representation theory, etc.).

The lifting of special relativity itself was then constructed first via the lifting of the Minkowski spacetime [25a] reviewed in Sect. 6.5, the lifting of the fundamental spacetime symmetries [25] also reviewed also in Section 6.5, and, finally, the lifting of the basic physical axioms, so as to achieve an articulated body of formulations as mutually compatible, invariant and axiomatically consistent as the conventional ones.

The main postulates of the covering isospecial relativity are specifically and solely constructed for *interior dynamical problems* and can be outlined as follows.

Recall that the original formulation of the Minkowski spacetime by Minkowski was based on the metric for dynamics in vacuum $\eta = \text{Diag.}\ (1, 1, 1, -c_0^2)$. For dynamics within physical media we should therefore consider the lifting $\eta = \text{Diag.}\ (1, 1, 1, -c_0^2) \rightarrow \hat{\eta} = \text{Diag.}\ (1, 1, 1, -c_0^2/n^2)$. However, such isometric is not properly symmetrized in space and time, thus requiring the fully symmetrized form $\hat{\eta} = \text{Diag.}\ (n_1^{-2}, n_2^{-2}, n_3^{-2}, -c_0^2/n_4^{-2})$. The latter can be reached via the application of a conventional Lorentz transform to an interval with isometric $\hat{\eta} = \text{Diag.}\ (1, 1, 1, -c_0^2/n^2)$, or simply via the diagonalization of $\hat{T}$ and the assumption $\hat{T}_{\mu\mu} = n_\mu^{-2}$, $n_4 = n$.

For simplicity we present the main postulates of the isospecial relativity for the simpler case with *space isotropy but spacetime anisotropy, i.e.*, for $n_1 = n_2 = n_3 = n_2 \neq n_4$ (see monograph 1-3c] for all details):

ISOPOSTULATE I: The maximal causal speed is

$$\hat{v}_{Max} = c_0 \times n_s / n_4; \tag{7.1}$$

ISOPOSTULATE II: The isorelativistic addition of speeds is:

$$v_{tot} = (u + v) / (1 + u_k \times n_k^2 \times v_k / c_0 \times n_4^2 \times c_0); \tag{7.2}$$

ISOPOSTULATE III: The isodilations of time and space are given by (where $\hat{\gamma}$ is given by Equation (6.5.3)

$$t' = \hat{\gamma} \times t, \quad r' = \hat{\gamma}^{-1} \times r; \tag{7.3}$$

ISOPOSTULATE IV: The isodoppler shift is given by:

$$\hat{\omega}' = \hat{\gamma}^{-1} \times \hat{\omega}; \tag{7.4}$$

ISOPOSTULATE V: The mass-energy isoequivalence is:

$$E = m \times c^2 = m \times c_0^2 / n_4^2. \tag{7.5}$$

A few comments are in order. First, the isospecial relativity does indeed achieve the desired invariance for arbitrary speeds of light $c = c_0/n$, $n = n_4$. For this purpose it is sufficient to use the isometric $\hat{\eta} = \text{Diag.}\ (n_1^{-2}, n_2^{-2}, n_3^{-2}, -c_0^2/n_4^{-2})$ in isointerval (6.5.1). The invariance follows from the universality of the Poincaré-Santilli isosymmetry for that isointerval, as the reader can verify.

The extension to arbitrary isorelativistic interior systems then follows by merely selecting more general isounits (see Paper III for explicit cases).

Second, it should be indicated that the isospecial relativity permits a symbiotic unification of the special and general relativity. This is permitted by the *Minkowski-Santilli isogeometry, i.e.*, the geometry of isospaces $\hat{M}$, studied in detail in monographs [1-3b,1-3c,25g].

The new geometry is a symbiotic unification of the Minkowskian and Riemannian geometries. In fact, it contains the isoimage of conventional aspects of the former (such as the light isocone), as well as all the machinery of the latter (covariant derivative, torsion, etc.).

All possible Riemannian metrics $g(x)$ are a simple particular case of the isometric $\hat{\eta}(x, v, \psi, \ldots)$. More specifically, all possible Riemannian metrics admit the isotopic decomposition $g(x) = \hat{T}(x) \times \eta$, where $\hat{T}(x)$ is necessarily positive-definite and η is the conventional Minkowski metric (because of the local Minkowskian character of Riemann).

Therefore, the isominkowskian geometry permits the identical reformulation of conventional gravitational equations for $g(x) \equiv \hat{\eta}(x)$, such as the Einstein-Hilbert field equations $G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2}\hat{\eta}_{\mu\nu} \times R = 0$. For brevity, I refer the reader to the latest presentation in memoir [25g].

A dominant property of the new geometry is that of being *isoflat*, that is, flat on isospaces over isofields. This implies the abandonment of the notion of curvature (because of the inconsistencies outlined in Section 1-3.3), and the reformulation of the Einstein-Hilbert field equations in a manifold with the covering notion of isoflatness.

For instance, the celebrated Schwarzschild line element is identically written in the isominkowskian form $\hat{d}s^2 = \hat{d}x_1^2 + \hat{d}x_2^2 + \hat{d}x_3^2 - \hat{d}x_4^2$, namely, *by embedding the Riemannian terms in the isodifferentials of the theory which therefore becomes Minkowskian.* Flatness is then regained in isospace.

The isominkowskian reformulation of gravity implies the resolution of a number of the truly serious controversies on the inconsistencies of the general relativity that have raged during this century, as outlined in Section 1-3.3 (see [25g] for brevity).

The extension to interior gravitational problems is then naturally permitted via the mere assumption of isometrics with a more general functional dependence, *e.g.*, in the velocities, $\hat{\eta} = \hat{\eta}(x, v)$ which is impossible for the Riemannian geometry. In this way one can obtain the Schwarzschild's line element for interior conditions with a locally varying speed of light.

More generally, we can say that *the isospecial relativity is directly universal for all possible spacetime theories with a symmetric metric.* This includes: 1) the preceding interior and exterior relativistic and gravitational cases; 2) Galilean-type theories with isounits $\hat{1} = \hat{1}_{space} \times \hat{1}_{time}$; 3) all possible symmetric generalizations of the Minkowskian geometry; 4) the indicated

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geometric unification of special and general relativities; 5) the first known axiomatically consistent grand unification of electroweak and gravitational interactions permitted precisely by the preceding features [25j].

The covering character of the isospecial over the conventional relativity is evident because the former applies for manifestly broader conditions, while admitting the latter as a simple particular case for $\hat{1} = I = \text{Diag.}(1, 1, 1, 1)$.

The maximal causal speed is not, in general, the local speed of light, but rather quantity (7.1), and it is the speed of light only in vacuum. This assumption is necessary to resolve the inconsistencies of special relativity for the Cerenkov light and other interior conditions (see volume [1-3c] for details).

I should finally mention for completeness that the relaxation of the symmetric character of the isometric implies the *genospecial relativity*; the additional relaxation of the single-valued character implies the *hyperspecial relativity*; the use of *isoduality* then permits corresponding images for antimatter.

The above generalized relativities have permitted a new generation of rather intriguing cosmologies which are based for the first time on universal *symmetries* rather than covariance and include, also for the first time, biological structures (as it should be from the very definition of "cosmos").

As an illustration, *isocosmology* predicts: an equal amount of matter and antimatter in the universe; identically null total characteristics of time, energy, charge, etc (because antimatter under isodual representation has all physical characteristics changed in sign); a dramatic decrease of the currently believed size of the universe (from Isopostulate IV as we shall see in Paper III); no need for the missing mass (thanks to Isopostulate V as we shall also see in Paper III); and other novel features.

The *genocosmology* implies an open and irreversible universe, while the broadest possible *hypercosmology* implies that the universe has multi-warps, each of which possessing conventional spacetime, each warp being open and irreversible.

In conclusion, the biggest technical and political obstacle for scientific studies of new energies is, in my view, the generally tacit assumption of the "universal constancy of the speed of light" c_0. When the physical evidence of the locally varying character of the speed of light is identified (and admitted), basically novel energies become merely consequential. Their quantitative-scientific treatment however requires the covering of the special relativity outlined in this section.

7. ISO-, GENO-, AND HYPER-CONDUCTIVITY

The new theory of isosuperconductivity has been constructed by Animalu [26a], Animalu and Santilli [26b] and others. As we shall see in Paper III, the resulting covering theory permits the first direct representation of the *attraction* of two *identical electrons* in the Cooper pair in a way which is in remarkable agreement with experimental evidence. The geno- and hyper-superconductivity can be constructed via the methods outlined earlier. Superconductivity aspects of new energies will be studied via the above novel theories.

8. ISO-, GENO- AND HYPER-CHEMISTRY

Hadronic mechanics has recently permitted the construction by Santilli and Shillady [27] of a covering of quantum chemistry called *hadronic chemistry*, which also possesses the iso-, geno- and hyper-branches for the description of closed-isolated molecular structures, irreversible chemical reactions and biological structures, respectively. Chemical aspects of new energies will be studied via the novel hadronic chemistry.

9. SIMPLE CONSTRUCTION OF CLASSICAL AND OPERATOR GENERALIZED THEORIES

It is important to know that the mathematical complexity of hadronic mechanics, hadronic superconductivity and hadronic chemistry is only apparent. In fact, the isomechanics can be constructed in *all* their parts via a systematic, step-by-step implementation of a simple *nonunitary transform* which is assumed to characterize precisely the isounit,

$$U \times U^{\dagger} = \hat{1} \begin{cases} \neq I \text{ for } r < 10^{-13} \text{ cm} \\ = I \text{ for } r > 10^{-13} \text{ cm.} \end{cases} \tag{9.1}$$

The above transform must then be applied, for consistency, to the *totality* of the quantum formalism with no exception known to me, including the unit itself, numbers and their operations, vector and Hilbert spaces, Lie's theory, etc., according to the general lines

$$\begin{aligned} I &\rightarrow U \times I \times U^{T} = \hat{1}, \\ c &\rightarrow U \times c \times U^{\dagger} = c \times (U \times U^{\dagger}) = c \times \hat{1} = \hat{c} \\ A \times B &\rightarrow U \times (A \times B) \times U^{\dagger} = \\ &= (U \times A \times U^{\dagger}) \times (U \times U^{\dagger})^{-1} \times (U \times B \times U^{\dagger}) = \hat{A} \hat{\times} \hat{1} \times \hat{B} = \hat{A} \hat{\times} \hat{B} \\ e^{X} &\rightarrow U \times e^{X} \times U^{\dagger} = (e^{X \times \hat{1}}) \times \hat{1} = \hat{e}^{\hat{X}}, \\ H \times |\psi\rangle &\rightarrow U \times (H \times |\psi\rangle) = \\ &(U \times H \times U^{\dagger}) \times (U \times U^{\dagger})^{-1} \times (U \times |\psi\rangle) = \hat{H} \hat{\times} |\hat{\psi}\rangle, \\ \langle\phi| \times |\psi\rangle &\rightarrow U \times (\langle\phi| \times |\psi\rangle) \times U^{\dagger} = \\ &= (\langle\phi| \times U^{\dagger}) \times (U \times U^{\dagger})^{-1} \times (U \times |\psi\rangle) \times (U \times U^{\dagger}) = \\ &= \langle\hat{\phi}| \hat{\times} |\hat{\psi}\rangle \times \hat{1}, \text{ etc.} \end{aligned} \tag{9.2}$$

In this way, isounits, isonumbers, isospaces, isoalgebras, etc. are all easily, uniquely, and unambiguously constructed by nonunitary transform (9.1).

Classical isomechanics is similarly constructed via the systematic *noncanonical map* $U \times U^{T} = \hat{1}$ applied to all aspects of Hamiltonian mechanics [1-3e].

An important condition for compatibility between quantum and isomechanics expressed in Equation (7.1) and in the notion of "hadronic horizon" (Figure 1) is that $\hat{1}$ must have the conventional value I everywhere, *except* at distances of 1 fm or less, in which I must be admitted as a particular case.

As an illustration, isounits (5.9) verify automatically the above conditions because it recovers the conventional unit whenever the overlapping of wavepackets is no longer appreciable.

Once achieved via the above simple transform, isomechanics remains invariant under any other possible *nonunitary* transform, provided that it is expressed in the isounitary form of Section 6.4, Equations (6.4.7).

The genomechanics are easily constructed via the *dual* nonunitary transforms [1-3d]:

$$U \times U^{\dagger} \neq I, \quad W \times W^{\dagger} \neq I,$$

$$U \times W^{\dagger} = I^{>}, \; W \times U^{\dagger} = {}^{<}I \begin{cases} \neq I \text{ for } r < 10^{-13} \text{ cm} \\ = I \text{ for } r > 10^{-13} \text{ cm.} \end{cases} \tag{9.3}$$

which must also be applied to the totality of the original formalism. This yields the dual generalizations of forward and backward genonumbers, $U \times n \times W^{\dagger} = n \times I > = n^{>}$ and $W \times n \times U^{\dagger} = {}^{<}I \times n = {}^{<}n$, the related forward and backward genoproducts $U \times (A \times B) \times W^{\dagger} = A' > B'$, $W \times (A \times B) \times U^{\dagger} = A' < B'$, etc.

The hypermechanics can be constructed via the relaxation of the single-valued character of transforms (9.5).

In conclusion, as we shall see in the following papers, the central problem for practical applications of iso-, geno- and hyper-mechanics is the identification of nonunitary transforms (9.1) or (9.5) which permits the consistent and invariant inclusion of internal nonhamiltonian effects missing in conventional quantum models.[3]

This property renders applications of iso-, geno- and hyper-mechanics rather easy because they are essentially constructed

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via simple nonunitary transforms of conventional quantum models.

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REFERENCES

1. R. M. Santilli, *Infinite Energy* **4**, No. 22, p. 33 (1998).
2. R. M. Santilli, *Nuovo Cimento* **51**, 571 (1967) [2a]; *Nuovo Cimento Suppl.* **6**, 1225 (1968) [2b]; *Meccanica* **1**, 3 (1969) [2c]; *Hadronic J.* **1**, 574 (1978) [2d]; *Foundations of Theoretical Mechanics*, Vol. I (1978) [2e] and II (1983) [2f]; *Hadr. J.* **1**, 228 (1978) [2g]; *Lie-Admissible Approach to the Hadronic Structure*, Vol. I (1978) [2h] and II (1982) [2i]; *Modern Phys. Letters* **13**, 327 (1998) [2j].
3. A. A. Albert, *Trans. Amer. Math. Soc.* **64**, 552 (1948).
4. J. M. Blatt and V F Weiskopf, *Theoretical Nuclear Physics*, Wiley, New York (1964).
5. W Band, *An Introduction to Quantum Statistics*, van Nostrand, Princeton (1955) [2b].
6. L. C. Biedernharn *J. Phys. A* **22**, L873 (1989) [6a]. A. Macfarlane, *J. Phys. A* **22**, L4581 (1989) [6b].
7. J. Lukierski, A. Viowiski and H. Ruegg, *Phys. Lett.* B **293**, 344 (1992). J. Lukierski, H. Ruegg and W. Ruhl, *Phys. Lett.* B **313**, 357 (1993).
8. F Bayer, M. Flato, C. Fronsdal, A. Lichnerowicz and D. Sternheimer, *Ann. Phys.* **111**, 61 and 111 (1978). C. Fronsdal, *Rep. Math. Phys.* **15**, 111 (1978).
9. A. Jannussis *et al*, *Nuovo Cimento* B **103**, 17 and 537 (1989). S. Sebawe Abdallah et al., *Physica A* **163**, 822 (1990).
10. Cl. George, F Henin, F Mayne and I. Prigogine, *Hadronic J.* **1**, 520 (1978).
11. J. Ellis, N. E. Mavromatos and D. V Nanopoulos in *Proceedings of the Erice Summer School*, 31st Course: *From Superstrings to the Origin of Space-Time*, World Scientific (1996).
12. P Caldirola, *Nuovo Cimento* **3**, 297 (1956). A.J annussis *et al. Lett. Nuovo Cimento* **29**, 427 (1980). D. Lee, *Phys. Rev. Lett.* **122**, 217 (1983).
13. R. N. Mahopatra, *Unification and Supersymmetries: The Frontiers of Quark-Lepton Physics*, 2nd ed., Springer-Verlag, (1992).
14. V G. Kac, *Infinite dimensional Lie Algebras*, Birkhauser, New York (1983).
15. D. F Lopez, in *Symmetry Methods in Physics*, A. N. Sissakian, G. S. Pogosyan and X. I. Vinitsky, Editors, JINR, Dubna, Russia (1994) and *Hadronic J.* **16**, 429 (1993) [13a]. A. Jannussis and D. Skaltsas, *Ann. Fond. L.de Broglie* **18**, 137 (1993) [13b].
16. R. M. Santilli, Origin, "Problematic aspects and invariant formulation of classical and quantum deformations," *Intern. J. Modern Physics A* **13**, issue no. 4 (1998), in press.
17 M. Razavy, *Z. Phys. B* **26**, 201 (1977). H.-D. Doebner and G. A. Goldin, *Phys. Lett. A* **16**, 397 (1992). H.-J. Wagner, *Z. Phys.* B **95**, 261 (1994)
18. G. W Mackey, *Unitary Group Representations in Physics, Probability and Number Theory*, Benjamin, New York, (1978).
19. D. Schuch, *Phys. Rev.* **55**, 955 (1997). [2e] R. M. Santilli, *Modern Phys. Letters A* **13**, 327 (1998) [2f].
20. S. Weinberg, *Ann. Phys.* **194**, 336 (1989). T F Jordan, *Ann. Phys.* **225**, 83 (1993).
21. S. Okubo, *Hadronic J.* **5**, 1667 (1982).
22. A. Jannussis, R. Mignani and R. M. Santilli, *Ann. Found. L. de Broglie* **18**, 371 (1993).
23. J. V Kadeisvili, *Math. Methods in Applied Sciences* **19**, 362 (1996). Gr T Tsagas and D. S. Sourlas, *Algebras, Groups and* (1996). Gr. T. Tsagas and D. S. Sourlas, *Algebras, Groups and Geometries* **12**, 1 and 67 (1995). D. Rapoport-Campodonico, *Algebras, Groups and Geometries* **8**, 1 (1991). R. Aslaner and S. Keles, *Algebras, Groups and Geometries* **14** 211 (1997). S. Vacaru, *Algebras, Groups and Geometries* **14**, 225 (1997). E. B. Lin, *Hadronic J.* **11**, 81 (1988) Gr. Tsagas, *Algebras, Groups and Geometries* **13**, 129 (1996).
24. S. L. Adler, *Phys. Rev.* **17**, 3212 (1978) S. Okubo, *Hadronic J.* **5**, 1667 (1982) R. Mignani, *Hadronic J.* **5**, 1120 (1982); *Nuovo Cimento Lett.* **39**, 413 (1984). A. Jannussis, R. Mignani and D. Skaltsas *Physica A* **187**, 575 (1992). C. N. Ktorides, H. C. Myung and R. M. Santilli, *Phys. Rev. D* **22**, 892 (1980). T Gill, J. Lindesay and W W Zachary, *Hadronic J.* **17**, 449 (1994). E. B. Lin, *Hadronic J.* **11**, 81 (1988). A. J. Kalnay, *Hadronic J.* **6**, 1 (1983). A. Kalnay and R. M. Santilli, *Hadronic J.* **6**, 1798 (1983). J. Fronteau, A. Tellez Arenas and R. M. Santilli, *Hadronic J.* **3**, 130 (1979). R. Mignani, H. C. Myung and R. M. Santilli, *Hadronic J.* **6**, 1878 (1983). A. O. E. Animalu and R. M. Santilli, in *Hadronic Mechanics and Nonpotential Interactions* (Nova Science, New York, 1990). R. Mignani, *Nuovo Cimento* **43**, 355 (1985). M. Gasperini, *Hadronic J.* **7**, 971 (1984). A. Jannussis, M. Mijatovic and B. Veljanowski, *Physics Essays* **4**, 202 (1991). M. Nishioka, *Nuovo Cimento A* **82** 351 (1984). A. Jannussis, D. Brodimas and R. Mignani, *J. Phys. A* **24**, L775 (1991). G. Eder, *Hadronic J.* **4**, 634 (1981) and **5**, 750 (1982). J. D. Constantoupoulos and C. N. Ktorides, *J. Phys. A* **17**, L29 (1984). A. Jannussis, G. Brodimas, and R. Mignani, *J. Phys. A* **24** L775 (1991). R. Mignani, *Physics Essays* **5**, 531 (1992).
25. R.M.Santilli, *Nuovo Cimento* Lett. **37**, 545 (1983) [25a]; *Hadronic J.* **8**, 25 and 36 (1985) [25b]; *JINR Rapid Comm.* **6**, 24 (1993) [c]; *Acta Appl. Math.* **50**, 177 (1998) [25d]; *J. Moscow Phys. Soc.* **3**, 255 (1993) [25e]; JINR Comm. No. E4-93-352 (1993) and *Chinese J. Syst. Eng. and Electr.* **6**, 177 (1996) [25f]; *Intern. J. Modern Phys. D* **7**, 351 (1998) [25g]; *Isotopic Generalization of Galilei's and Einstein's Relativities*, Vol. I [25h] and II [25i], Hadronic Press (1991); *Found. Phys. Letters* **10**, 307 (1997) [25j].
26. A. O. E. Animalu, *Hadronic J.* **17**, 379 (1994) [26a]. A. O. E. Animalu and R. M. Santilli, *Intern. J. Quantum Chemistry* **29**, 175 (1995) [26b].
27 R. M. Santilli and D. D. Shillady, "Isochemical model of the Hydrogen molecule", *Intern. J. Hydrogen Energy* (1998), in press [27a]; "Isochemical model of the water molecule", *Intern. J. Hydrogen Energy* (1999), in press; *Ab initio* hadronic chemistry, in *Fundamental Open Problems in Science at the Turn of the Millennium*, T Gill *et al.*, editors (1999), in press [27c].
28. M. Kaku and J. Thompson, *Beyond Einstein*, Anchor Books (1995) [28b]. N. S. Sanchez, editor, *String Theory in Curved Spacetime*, World Scientific, Singapore (1998) [28b]. M. Gasperini, M. Giovannini, A. K. Meissner and G. Veneziano, in preceding volume [28c].

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Dr. Santilli's complete biographical sketch can be found on page 49 of *IE* No. 22

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Physical Laws of the Emerging New Energies as Predicted by Hadronic Mechanics, IIIA: Structure of the Neutron and New Energies of Class I*

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Editor's Note: This article by Dr. Santilli follows the preceding rather difficult theoretical treatment by citing specific experimental results from nuclear accelerators that bear on deviations from quantum mechanics. He says his hadronic mechanics can explain and predict these deviations.

He focuses in this article on "Class I" energies, which "originate in the structure of the neutron or hadrons at large, thus being sub-nuclear." He maintains that "quantum mechanics is not exactly valid in the interior of hadrons due to their hyperdense structure, which implies novel, internal, nonlinear, nonlocal, and nonpotential. . .effects." Not only that, but Einsteinian relativity also goes out the window in said hadron interiors.

Leaping from the microcosm of events seen in particle accelerators, Dr. Santilli tackles the larger cosmos, beginning in Section 2.7: "Experimental Verifications in Astrophysics and Cosmology." He brings up a mystery, which most astrophysicists with the exception of Dr. Halton Arp and his followers, do not consider a mystery at all. Namely, that certain quasars (quasi-stellar objects) have an associated "cosmological redshift" dramatically bigger than their associated galaxies. Mainstream astrophysicists "explain away" this mystery by stating that the quasars are *not* physically connected with the associated galaxies—they just happen to appear near them on the great celestial sphere as seen from our solar system. As Arp states in his book, *Seeing Red: Redshifts, Cosmology, and Academic Science* (Apeiron, 1998 Montreal, Canada): " .if the causes of these redshifts is misunderstood, then distances can be wrong by factors of 10 to 100, and luminosities and masses will be wrong by factors up to 10,000. We would have a totally erroneous picture of extragalactic space, and be faced with one of the most embarrassing boondoggles in our intellectual history."

Dr. Santilli suggested in 1991 that the difference in redshift between a quasar and an associated galaxy could be explained by the "slow-down of the speed of light in the huge quasar chromospheres." He suggests possible experimental verifications of his "isominkowskian geometry and isospecial relativity."

In the continuation of this paper in subsequent issues, Dr. Santilli will discuss "Class II" new energies that "originate in the structure of nuclei, with possible contributions of Class I." And, important for such apparently energetically and molecularly anomalous gases such as AquaFuel™ or CarboHydrogen Gas™ which this magazine has dealt with in past issues, Dr. Santilli will discuss experimental support for "Class III" new energies that orginate in "the structure of atoms and molecules, with possible contributions from Class I and Class II."—*EFM*

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1. CLASSIFICATION OF NEW ENERGIES STUDIED AT TOUPS TECHNOLOGY LICENSING, *INFINITE ENERGY*, AND NEW ENERGY RESEARCH LABORATORY

In the preceding Papers I and II [1], I presented the necessary conceptual and theoretical foundations of new forms of energy not predicted by conventional theories (Definition I-1.2.1).

In this Paper III, I initiate the experimental and industrial analysis of new energies under study at Toups Technology Licensing (a U.S. public company with headquarters in Largo, Florida; see web site [2]), as well as the new energies presented in *Infinite Energy*, and being studied at its affiliated New Energy Research Laboratory (NERL), which include:

1) New energies originating in the structure of the neutron and other strongly interacting particles called *hadrons*, thus originating at the *subnuclear-particle level* (hadronic energy, and others studied in this paper);

2) New energies originating at the *nuclear level* (cold fusion, and others studied in Paper IV); and

3) New energies originating at the *atomic-molecular level* (new clean fuels under development by Toups Technology Licensing, and other energies, to be studied in Paper V).

The main objective of these papers is to show that the novel *hadronic mechanics* [3] outlined in Paper II permits a numerical, consistent, and invariant treatment of *all* new energies. The main hope is that the availability of such a unifying theory will permit the increase of present efficiencies, the identification of alternative means of producing new energies, and the development of new industrial applications.

I initiated the analysis in Paper I by presenting an outline as comprehensive as possible of the insufficiencies of quantum mechanics in most branches of science, which is a *mandatory* requirement for the study of covering mechanics.

In Paper II [1b,1c], I have: 1) indicated that the insufficiencies originate from the lack of representation by quantum mechanics of the nonlinear, nonlocal, and nonpotential effects due to deep overlapping of the extended wavepackets of particles; 2) outlined "catastrophic" inconsistencies suffered by various generalized theories treated with conventional mathematics; 3) introduced new mathematics specifically constructed for the resolution of these inconsistencies; 4) presented the main axiomatic lines of *hadronic mechanics* [3], which, to my best knowledge, is the only known generalized theory capable of resolving said inconsistencies and providing an *invariant* description of nonlinear, nonlocal, and nonpotential interactions (communication to this author of other generalized theories with a rigorous mathematical proof of their consistency and invariance would be appreciated); and 5) presented elementary rules accessible to all for the explicit construction of hadronic models (without the use of generalized mathematics), which consist of simple nonunitary transforms of conventional quantum models.

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I begin the analysis of this paper with the following classifications of the energies under study at Toups Technology Licensing, *Infinite Energy*, and the New Energy Research Laboratory:

DEFINITION 1.1: The new energies as per Definition I-1.2.1 are said to be of:

CLASS I, when they originate in the structure of the neutron or hadrons at large, thus being sub-nuclear;

CLASS II, when they originate in the structure of nuclei, with possible contributions of Class I;

CLASS III, when they originate in the structure of atoms and molecules, with possible contributions of Classes I and II.

This Paper III is devoted to a study of new energies of Class I via nonrelativistic and relativistic hadronic mechanics, while the study of the new energies of Classes II and III will be conducted in subsequent papers.

I should stress that the beauty of scientific inquiries is their polyhedricity. By no means is hadronic mechanics intended to be the only possible theory for new energies, and the study of alternative theories is here encouraged.

However, to separate science from fiction, alternative theories have to be proved: 1) To represent all the same data represented by hadronic mechanics; 2) To be as *consistent and invariant* as hadronic mechanics; and 3) To be *inequivalent* to the latter (which is an evident necessary condition for novelty). By keeping in mind the direct universality of hadronic mechanics, the above tasks 1), 2), and 3) appear to be rather difficult, if not impossible.

In fact, if a given theory has a linear, local, and unitary time evolution, it has no relevance for these papers, because it is within the class of equivalence of quantum mechanics. If a given theory has a nonlinear, and/or nonlocal, and/or nonunitary time evolution, it is indeed of interest for these papers, although it is within the class of equivalence of hadronic mechanics.

This includes some of the most general theories conceivable at this time, such as those formulated on ordered multivalued hypernumbers with a countable infinity of geno-quaternions. In any case, the formulation of single-valued, bi-valued or multi-valued nonunitary theories via the formalism of hadronic mechanics is *necessary* to avoid the catastrophic inconsistencies of Section II-4.

Stated in a nutshell, *the fundamental condition for the existence of new energies of Class I is that quantum mechanics is not exactly valid in the interior of hadrons due to their hyperdense structure, which implies novel, internal, nonlinear, nonlocal, and nonpotential (thus nonhamiltonian and nonunitary) effects (Papers I and II).*

Hadronic mechanics has been built to preserve all *exterior* characteristics of hadrons (technically achieved via the preservation of the generators in the transition from Lie to Lie-Santilli isosymmetries), while admitting an invariant representation of the most general possible internal nonunitary effects (technically achieved via generalized units).

In this Paper III-A, I outline part of the rather vast body of experimental evidence supporting the validity within the hadronic structure of nonrelativistic and relativistic hadronic mechanics, and related isogalilean and isopoincaré symmetries.

In Paper III-B, I review: A) The exact, numerical, consistent, and invariant representation of *all* characteristics of the neutron as a bound state of one proton and one electron according to the historical legacy of Rutherford, as first achieved by Santilli in 1990 via hadronic mechanics; B) The consequential new structure model of unstable hadrons with ordinary physical constituents, and its compatibility with the SU(3) Mendeleev-type classification of hadrons; and C) Examples of new energies of Class I, and some of their expected industrial applications.

2. EXPERIMENTAL VERIFICATIONS OF HADRONIC MECHANICS IN PARTICLE PHYSICS, ASTROPHYSICS AND COSMOLOGY

2.1. Statement of Objectives

As stressed in Paper I, the most insidious obstructions for new energies are special relativity, its underlying relativistic quantum mechanics, and quark theories/quantum chromodynamics (QCD) [4].

In Paper I, I have expressed the view (opposed by some colleagues in new energies) that *special relativity is exactly valid for relativistic exterior dynamical problems* (particles moving in vacuum at large mutual distances under only long range interactions), while special relativity is *inapplicable* (and not "violated") for the much broader and more complex *relativistic interior dynamical problems* (particles at short mutual distances in conditions of deep overlapping of their wavepackets, thus experiencing long range as well as contact interactions).

The experimental verification of the validity of the special relativity for exterior conditions is established on a daily basis in particle accelerators (I here refer specifically to *mathematical* treatments yielding *numbers* which are verifiable with *tests*, and exclude epistemological aspects).

In Paper I, I have also expressed the view that the SU(3)-color theory provided the final *Mendeleev-type classification of hadrons into families*, while the problem of the structure of the individual hadrons requires a new mechanics permitting the identification of hadronic constituents with ordinary massive particles, generally those produced in the spontaneous decay with the lowest mode (tunnel effect of the constituents [3a]), much along the Mendeleev classification of atoms and structure of individual atoms which required the advent of a new mechanics.

The return to ordinary physical particles as hadronic constituents then permits the new energies of Class I, as we shall see, much along the case of conventional nuclear and atomic energies.

In this section I shall outline the experimental evidence on the inapplicability of special relativity and relativistic quantum mechanics for *interior* problems (only), and the consequential validity of their isotopic coverings.

The latter evidence establishes the foundations of the new model of structure of the neutron and hadrons outlined in Section 3, and voids the conjecture that quarks are the physical constituents of hadrons (evidently because of the inapplicability of their dynamical foundations). Jointly, the experimental evidence presented in this section reinforces the validity of special relativity, SU(3) and QED for the *exterior* classification-type description of hadrons, thus permitting new energies as per Definitions I-1.2.1 and II-1.1 without any conflict.

2.2. Insufficiencies of Special Relativity and the Universality of its Isotopic Covering

As reviewed in detail in Paper I, the "universal constancy of the speed of light" c_0 is a political abstraction, because *in physical reality the speed of light is a local variable* c depending on position r, frequency ω, density μ, temperature τ, and other local characteristics of the medium in which it propagates, according to the known expression $c = c_0/n(r, \omega, \mu, \tau, ...)$, where n is the local index of refraction.

The validity of special relativity for propagation of light in vacuum has been recalled earlier. I assume the reader is aware of

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the huge inconsistencies of special relativity when misused to represent locally varying speeds c, as outlined in Section I-3.

It follows that the experimental evidence on the inapplicability of special relativity for interior conditions is provided by the mere inspection of physical evidence in our environment, such as the refraction of light (the apparent bending of a straight stick when partially immersed in water).

In fact, this evidence requires a *decrease of the speed of light* at the point of bending and below, thus establishing the *inapplicability* (and not the violation) of special relativity in water because of numerous serious inconsistencies outlined in Paper I (violation of causality because particles can travel in water faster than light, violation of the relativistic composition of speeds, lack of invariance for locally varying speeds, etc.).

If special relativity is inapplicable for media of low density, the belief that it is exactly valid for hyperdense media as existing in the interior of hadrons or stars has *zero credibility*, as disproved by the experimental evidence presented in this section. The door is then open for basically new forms of energies.

The above scenario has mandated the construction of the covering *isospecial relativity*, with underlying *isominkowskian spaces* and *isopoincaré symmetry* in their classical and operator formulations [3], as outlined in Paper II.

Isospecial relativity is axiomatically consistent, invariant and "directly universal," *i.e.*, including all infinitely possible signature-preserving modifications of the Minkowski space (universality), directly in the frame of the observer (direct universality).

A primary purpose of this section is to identify some of the available direct experimental verifications of isospecial relativity for interior problems in hadron physics, as a prerequisite for new energies.

Another basic notion the reader should keep in mind from these introductory lines is that *special and isospecial relativities coincide at the abstract, realization-free level* by conception and construction (Section II-6). It then follows that *isospecial relativity extends the arena of applicability of special relativity from exterior conditions in vacuum, to universal interior conditions*, as we shall see in this section.

2.3. Experimental Verification with Data on the Local Speed of Light

Speeds $c<c_0$ $(n > 1)$ for media of low density, such as our atmosphere, were studied by numerous authors at the turn of this century, most notably by Lorentz [5a] (see the quotation by Pauli [5b]). These studies were then ignored for the rest of this century because they are not compatible with special relativity.

In fact, various machinations were concocted to adapt physical reality to special relativity, all discredited for various inconsistencies reviewed in Paper I (*e.g.*, the old reduction to light scattering among the molecules of a medium has been discredited by the experimental evidence of superluminal speeds and other measurements).

Speeds $c>c_0$ $(n < 1)$ have been considered throughout this century, first at the level of science fiction and then gradually becoming scientific reality (see, *e.g.*, the papers in [6a] and references quoted therein).

A study on speeds $c > c_0$ directly relevant for these papers is the hypothesis submitted by R. M. Santilli [6b] in 1982 that *the maximal causal speed in the interior of hadrons is generally bigger than that in vacuum*, or, more generally, that *contact interactions can accelerate ordinary masses at arbitrary speeds beyond* c_0.

The main argument of [6b] is that the maximal possible speed under *action-at-a-distance interactions* is indeed c_0, as well-known and experimentally established, *e.g.*, in particle accelerators. However, under contact effects, the maximal causal speed is arbitrary because the energy balance of the latter is dramatically different than that of the former, as classically verified, *e.g.*, in the acceleration of a balloon by the atmosphere.

Subsequently, V. de Sabbata and M. Gasperini [6c] conducted the first phenomenological verification of the above hypothesis for the interior of hadrons via the use of conventional gauge theories, by obtaining under extreme conditions maximal causal speeds up to $c = 75\, c_0$.

More recently, various astrophysical measurements [7] have established the validity of the hypothesis submitted in [6b], by detecting masses expelled in astrophysical explosions (thus under contact interactions) at speeds $c > c_0$.

Additional experimental verifications of speeds $c > c_0$ have been made [8] for photons propagating in certain guides (see the forthcoming review of all superluminal speeds by E. Recami [8c]).

As is well-known, the celebrated *Minkowski space* $M(x,\eta,R)$ [9a] and related *Minkowskian geometry* (see Section II-6.5 for notations) provide a *direct and invariant geometrization of the speed of light in vacuum*, where the term "direct" is referred to the representation of the speed c_0 in the metric itself (as originally written by Minkowski [9a]), $\eta = \text{Diag.}\ (1, 1, 1, -c_0^2)$, and "invariant" is referred to the fact that the most general class of admissible transformations, those of the Poincaré symmetry, leave η, thus c_0, invariant.

The admission of the experimental reality that, in general, the speed of light has the local value $c = c_0/n \neq c_0$, evidently creates the problem of its geometrization in a way as direct and invariant as that in vacuum.

To my best knowledge, the first direct and invariant representation of arbitrary speeds of light (or of arbitrary local causal speeds) was reached in 1983 by R. M. Santilli [9b] via the *isominkowskian spaces* $\hat{M}(\hat{x},\hat{\eta},\hat{R})$ (see also Section II-6.5 for a review and notations) which confirmed the prediction of speeds $c > c_0$ for hyperdense media submitted in the preceding paper [6b].

The *isominkowskian geometry* was subsequently studied in various works (see the latest presentation in memoir [9c]). Catastrophic mathematical and physical inconsistencies of other generalizations of the Minkowski space were treated in detail in memoir [9d].

A conceptual-nontechnical outline of these studies can be summarized as follows. Recall that all unitary transforms of relativistic quantum mechanics (*e.g.*, those of the Poincaré symmetry) are defined by the invariance $\eta \to \eta' = W\times\eta\times W^\dagger = \eta$. Therefore, the map $\eta = \text{Diag.}\ (1, 1, 1, -c_0^2) \to \hat{\eta} = W\times\eta\times W^\dagger = \text{Diag.}\ (1, 1, 1, -c_0^2/n^2)$ is necessarily *nonunitary* (with a *noncanonical* counterpart at the classical level here ignored).

This activates *relativistic hadronic mechanics* (Section II.6.5) as the *only known invariant theory*. The invariance of the representation requires that the nonunitary transform is identified with the new basic unit of the theory (the *isounit*) and consequently, the *totality* of the original Minkowskian formulation is subjected to the same nonunitary transform with no exception known to me.

This implies the nonunitary lifting of numbers and fields, metric and Hilbert spaces, geometries and topologies, etc., via the elementary rules of Section II-9,

$$1 \to \hat{1} = U \times 1 \times U^\dagger = \hat{1} = \text{Diag.}\ (1, 1, 1, n^2),\quad \hat{1}^{-1} = (U \times U^\dagger)^{-1}, \tag{2.1a}$$

$$n \in R(n,+,\times) \to \hat{n} = U\times n\times U^\dagger = n\times(U\times U^\dagger) = n\times\hat{1} \in \hat{R}(\hat{n},\hat{+},\hat{\times}), \tag{2.1b}$$

$$A\times B \to U\times(A\times B)\times U^\dagger =$$

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$$= (U\times A\times U^\dagger)\times(U\times U^\dagger)^{-1}\times(U\times B\times U^\dagger = A'\times\hat{1}\times B' = A'\hat{\times}B' \qquad (2.1c)$$

$$x^2 = x\times\eta\times x^\dagger \rightarrow U\times x^2\times U^\dagger = U\times(x\times\eta\times x^\dagger)\times U^\dagger =$$

$$= (U\times x^\mu\times U^\dagger)\times((U\times U^\dagger)^{-1}\times\eta_{\mu\nu})\times(U\times x^\nu\times U^\dagger)^\dagger =$$

$$= \hat{x}^\mu\times\eta_{\mu\nu}\times\hat{x}^\nu \in \hat{R}(\hat{n},\hat{+},\hat{\times}), \qquad (2.1d)$$

$$\eta = \text{Diag.}(1, 1, 1, -c_0^2) \rightarrow \hat{\eta} = (U\times U^\dagger)^{-1}\times\eta =$$

$$= \text{Diag.}(1, 1, 1, -c_0^2/n^2) \qquad (2.1e)$$

The direct representation of arbitrary speeds $c = c_0/n$ is then evident. Its extreme simplicity as well as direct universality under a nonunitary transform should be noted. Once the above nonunitary theory is achieved, its invariance is established for all possible additional nonunitary transforms $W\times W^\dagger = 1 \neq I$, *provided* that they are treated via *isomathematics* (Section II-5).

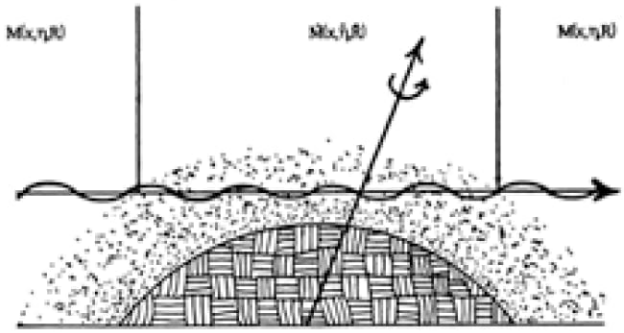

FIGURE 1: A representation of the propagation of light in our atmosphere with Santilli's isominkowskian geometry (9b-9e) and the conventional geometry in empty space.

This essentially implies that the nonunitary transforms on M over R are identically rewritten in the form $W = \hat{W}\times\hat{1}^{1/2}$ yielding the *isounitary transform* on $\hat{M}$ over $\hat{R}$ $W\times W^\dagger = \hat{W}\hat{\times}\hat{W}^\dagger = \hat{W}^\dagger\hat{\times}\hat{W} = \hat{1}$. Then, and only then, it is easy to prove the invariance of the isounit, $\hat{1}\rightarrow\hat{1}' = \hat{W}\hat{\times}\hat{1}\hat{\times}\hat{W}^\dagger = \hat{1}$, of the isoproduct $A\hat{\times}B \rightarrow \hat{W}\hat{\times}(A\hat{\times}B)\hat{\times}\hat{W}^\dagger = A'\hat{\times}B'$, etc.

The invariance of arbitrary speeds of light is established by the Poincaré-Santilli isosymmetry $\hat{P}(3.1)$ [10,11] for the particular isounit $\hat{1}$ here considered. The applicability of the *isospecial relativity* [3] then follows (see also Section II-6.5).

The above direct and invariant representation of arbitrary speeds of light constitutes the *first experimental verification of the isospecial relativity and relativistic hadronic mechanics.*

2.4. Experimental Verifications Via Phenomenological Calculations of Hadronic Media

Isominkowskian model (2.1) is a particular case of Santilli's general isominkowskian line element [9b],

$$U\times U^\dagger = \hat{1} = \text{Diag.}(b_1^{-2}, b_2^{-2}\, b_3^{-2} - b_4^{-2}) =$$

$$= \text{Diag.}(n_1^2, n_2^2, n_3^2, n_4^2) = 1/\hat{1} > 0,\ b_\mu^2 = n_4^{-2} > 0, \qquad (2.2a)$$

$$\hat{\eta} = (U\times U^\dagger)^{-1}\times\eta = \text{Diag.}(b_1^2, b_2^2, b_3^2, -c_0^2\times b_4^2) =$$

$$= \text{Diag.}(1/n_1^2, 1/n_2^2, 1/n_3^2, -c_0^2/n_4^2), \qquad (2.2b)$$

$$\hat{x}^2 = \hat{x}^\mu\times\hat{\eta}_{\mu\nu}\times\hat{x}^\nu =$$

$$= \hat{x}^1\times b_1^2\times\hat{x}^1 + \hat{x}_2\times b_2^2\times\hat{x}^2 + \hat{x}^3\times b_3^2\times\hat{x}^3 - \hat{x}^4\times b_4^2\times\hat{x}^4 =$$

$$= \hat{x}^1\times\hat{x}^1/n_1^2 + \hat{x}_2\times\hat{x}^2/n_2^2 + \hat{x}^3\times\hat{x}^3/n_3^2 - \hat{t}\times\hat{t}\times c_0^2/n_4^2, \qquad (2.2c)$$

where: $n_4 = b_4^{-1} = n$ is the index of refraction representing the *density* of the medium considered as compared to the vacuum, which is assumed to have density $n_4 = b_4^{-1} = n = 1$; the n_k's emerge from the spacetime symmetrization of n_4 (or application of the Lorentz transforms to interval (2.1)); and the "hat" in the $\hat{x}$'s indicates measurements on $\hat{M}$ over $\hat{R}$, a notation omitted hereon for simplicity.

The quantities $n_\mu = b_\mu^{-1}$ are called the *characteristic functions* of the medium considered. When a hadron is considered from the outside, the n's and b's are averaged into constants usually denoted $n_\mu^* = b_\mu^{*-1}$ As an example, the n's are functions when describing the *local* speed of light in the interior of our atmosphere. On the contrary, when inspected from the outside, the passage of light throughout our atmosphere can be described via the *average* of n_4 to the constant n^*_4

Note that isometric (2.2b) is the most general possible isometric under the assumed topological conditions of being symmetric, real-valued, and nowhere singular (see the geno- and hyper-metrics of Paper II for relaxations of these conditions).

The first experimental verification of the full isominkowskian formulation (2.2b) for the geometrization of media in the interior of hadrons has been provided by H. B. Nielsen and I. Picek [12] (of the Niels Bohr Institute in Copenhagen, Denmark), who conducted extensive phenomenological calculations via conventional gauge theories in the Higgs sector, and derived the following isometrics for the interior of pions and kaons, respectively,

$$\hat{\eta} = \text{Diag.}[(1 - \alpha/3, (1 - \alpha/3), (1-\alpha/3), -c_0^2 > (1 - \alpha)] =$$

$$= \text{Diag.}(b_1^2, b_2^2, b_3^2, -c_0^2\times b_4^2) =$$

$$= \text{Diag.}(1/n_1^2, 1/n_2^2, 1/n_3^2, -c_0/n_4^2), \qquad (2.3a)$$

$$\text{PIONS } \pi^\pm\text{: } b^*_1{}^2 = b^*_2{}^2 = b^*_3{}^2 = 1 + 1.2\times10^{-3},\ b^*_4{}^2 = 1 - 3.79\times10^{-3}, \qquad (2.3b)$$

$$\text{KAONS } K^\pm\text{: } b^*_1{}^2 = b^*_2{}^2 = b^*_3{}^2 = 1 - 2\times10^{-4},\ b^*_4{}^2 = 1 + 6.1\times10^{-4}, \qquad (2.3c)$$

As one can see, *the phenomenological results by Nielsen and Picek [12] constitute the second experimental verification of the isospecial relativity and relativistic hadronic mechanics*, including the hypothesis (6b,9b) of speeds $c > c_0$.

In fact, for pions we have $b^*_4 < 1$ and speeds $c < c_0$, while for kaons we have $b^*_4 > 1$ and $c > c_0$. Since the density of hadrons increases with mass, speeds $c > c_0$ are expected to persist for all heavier hadrons, as confirmed by subsequent data.

Again, the simplicity and universality of the isominkowskian geometry in representing data [12] should be kept in mind.

In closing, I should indicate that *particles traveling in interior conditions faster than light in vacuum are not tachyons, but ordinary, conventional, massive particles.* In fact, the notion of tachyons must be re-defined for the considered experimental data as *particles traveling faster than the local maximal causal speed* (which *is not* that of light, as shown in Section II-6.5, since interior physical media are generally opaque to light anyhow).

2.5. Experimental Verification with the Behavior of the Meanlife of Unstable Hadrons with Speed

The hyperdense character of the medium inside hadrons has been known since the discovery of protons and neutrons. In turn, dynamics within hyperdense media lead to the historical open legacy that strong interactions have a *nonlocal* component due to deep wave-overlappings, namely, a component that violates special relativity.

In fact, strong interactions have a range of 1 fm (= 10^{-13} cm) which *coincides* with the size of all hadrons, as well as with the

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size of the wavepackets of all particles. It then follows that, unlike electromagnetic interactions, a necessary condition to activate strong interactions is that hadrons enter into conditions of deep mutual overlappings. The nonlocality of these conditions is then consequential.

In particular, to be physical, the hadronic constituents must have wavepackets of the order of the entire hadrons. This implies that, unlike the atomic constituents, the hadronic constituents are in condition of total mutual penetration of their wavepackets, one inside all others, thus resulting again in a nonlocal structure.

To my best knowledge, the first experimental verification of nonlocal internal effects in the structure of hadrons was studied in 1964 by D. L. Blokhintsev [13a] (of the JINR in Dubna, Russia), who suggested the *measure in a particle accelerator of the behavior of the meanlives of unstable hadrons with speed (or energy).*

In essence, Blokhintsev argued that the behavior of meanlives of unstable hadrons with the speed v (or the energy imv^2) should *not* follow the prediction of special relativity

$$\tau = \tau_0 \times (1 - v_k \times v_k / c_0 \times c_0)^{-1/2} \qquad (2.4)$$

Deviations from the above Minkowskian law would then establish dynamical effects in the interior of hadrons beyond special relativity (interior problem).

Note that such deviations are fully compatible with the exact verification of special relativity for the center-of-mass trajectory of the same particle (exterior problem).

The studies by Blokhintsev and his group in Russia were continued by L. B. Redei [13b] in Italy, D. Y. Kim [13c] in Canada, and others.

A rather unsettled feature of these studies is that they proposed different generalizations of the Minkowskian law (2.4), thus creating the problem of which law to test.

In 1983 R. M. Santilli [9b] proposed the isominkowskian spaces $\hat{M}(\hat{x},\hat{\eta},\hat{R})$ with isometric (2.2) and generalized law

$$\tau = \tau_0 \times (1 - v_k \times b_k^2 \times v_k / c_0 \times b_4^2 \times c_0)^{-1/2} =$$
$$= \tau_0 \times [1 - (v_k \times v_k / n_k^2) / (c_0^2 / n_4^2)]^{-1/2}. \qquad (2.5)$$

A. K. Aringazin [14] then proved that the above isominkowskian law is *directly universal* for all possible (signature preserving) modifications of the Minkowski space (as expected from the direct universality of the isominkowski spacetime).

All generalized laws [13] can be obtained as particular cases of isolaw (2.5) via different expansions in terms of different coefficients subjected to different truncations [14]. Rather than testing a variety of seemingly different laws, the experiments can be solely conducted for isotopic law (2.5).

The first direct experimental measurement of the behavior of the meanlife of the unstable K°s with energy was conducted in 1983 by S. H. Aronson *et al.* [15a] at Fermilab suggesting *deviations* from the Minkowskian law (2.4) in the energy range from 30 Gev to 100 GeV.

Additional direct experimental measurements were conducted in 1987 by N. Grossman *et al.* [15b] also at Fermilab, showing apparent *verification* of the Minkowskian law, although in the *different* energy range from 100 to 400 GeV.

Moreover, a test of the decay law at short decay times was made by G. Alexander *et al.* at LEP [15c], in which the events $Z^0 \rightarrow \tau^+ \tau^-$ show a *deviation* from the conventional law of the order of 1.1%.

In paper [16a] of 1992, F. Cardone (then of the First University in Rome, Italy) *et al.* proved that *Santilli's isominkowskian spaces permit an exact fit of experimental data* [15a] (see Figure 2).

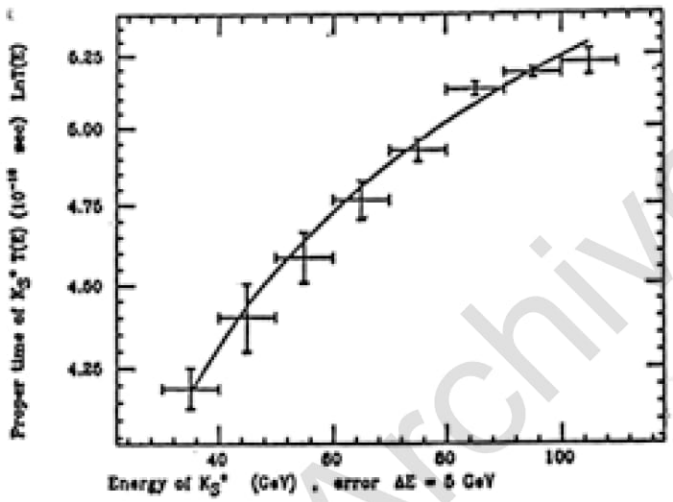

FIGURE 2: The exact fit of Santilli's isominkowskian law (2.5) [9b] provided by Cardone *et al.*[16a] on the data of Fermilab experiment [15a].

In the subsequent paper [16b], F. Cardone *et al.* proved that the same isominkowskian representation *unifies* the seemingly discordant results of tests [15a] and [15b] (Figure 3).

In this way, Cardone *et al.* achieved the following numerical values of the characteristic constants for the K°s:

$$b^{\circ}_1{}^2 = b^{\circ}_2{}^2 = b^{\circ}_3{}^2 = 0.989080 \pm 0.0004; \qquad (2.6a)$$

$$b^{\circ}_4{}^2 = 1.002 \pm 0007; \qquad (2.6b)$$

$$\Delta b^{\circ}_k{}^2 = 0.007, \ \Delta b^{\circ}_4{}^2 = 0.001 \qquad (2.6c)$$

It is evident that *the above fits constitute the third experimental verification on the validity of the isominkowskian geometry and relativistic hadronic mechanics for the characterization of media in the interior of hadrons.*

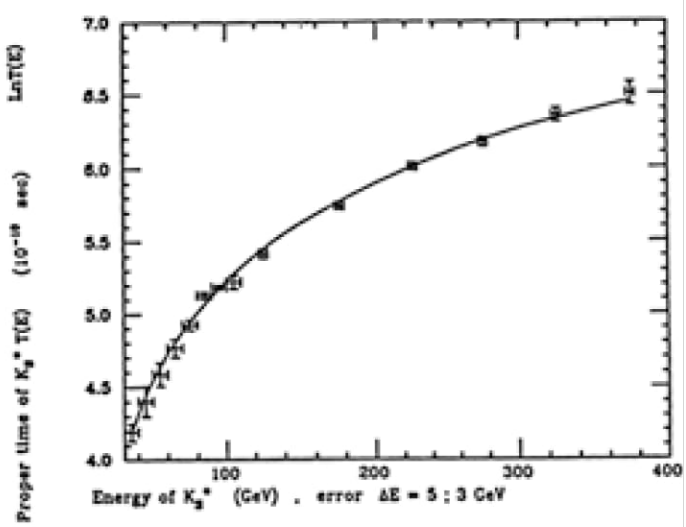

FIGURE 3: The exact fit of Santilli's isominkowskian law (2.5) [9b] provided by Cardone *et al.*[16b] on the data of both Fermilab experiments [15a] and [15b].

Results (2.3) and (2.6) have the following important implications:
1) They confirm in a completely independent way that the

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maximal causal speeds in the interior of kaons is bigger than that in vacuum. In fact, values (2.6b) are very close to values (2.3b) even though derived in different ways (the former via direct measurements and the latter via phenomenological calculations).

2) Results (2.3) and (2.6) confirm that the quantity $b^*_4 = 1/n^*_4$ characterizes the *density* of the hadron considered (normalized to the value $b^*_4 = 1/n^*_4 = 1$ for the vacuum), while the dependence of the characteristic functions on the speed (or energy) is essentially in the space components $b^*_k = 1/n^*_k$ (also normalized to the values $b^*_k = 1/n^*_k = 1$ for the vacuum).

3) Results (2.3) and (2.6) void the measurements by Grossman *et al.* [15b] of any conclusive value, evidently because we have experimental deviations from the Minkowskian geometry even under the assumption that tests [15b] are valid.

4) Results (2.3) and (2.6) establish that the rest energy of the constituents of hadrons *is not* given by the familiar expression $E = m \times c_0^2$, but rather by the isorenormalized Equation (II-7.5), *i.e.*,

$$E_{\text{Hadr. Const.}} = m \times c^2 = m \times c_0^2 \times b_4^2 = m \times c_0^2 / n^*_4{}^2, \quad (2.7)$$

with a value evidently *bigger* than that currently believed from the kaon on.

5) Results (2.3) and (2.6) establish that the frequency ν of photons or gluons emitted in the interior of hadrons *is not* characterized by the traditional law $E = h \times \nu$, but instead by the isorenormalized law

$$\hat{\nu} = \nu / n^*_4{}^2, \quad (2.8)$$

with evident *isoredshift* (tendency toward the red due to physical media) for the π^* and *isoblueshift* (tendency toward the blue) for kaons and all other hadrons.

6) Results (2.3) and (2.6) establish that light emitted in the interior of hadrons is also *isoredshifted* or *isoblueshifted*, that is, it reaches the outside at a frequency smaller or bigger than that originally emitted in the interior because of mechanisms of the isospecial relativity studied in astrophysical applications (essentially due to release or absorption of energy from the medium).

7) Results (2.3) and (2.6) establish that *in the interior of kaons and all other heavier hadrons, space becomes smaller and time flows faster than in the exterior.* In fact, the basic units of space and time following experimental fits (2.6) are given by

$$\hat{1} = \text{Diag.}\,(\hat{1}_{\text{space}}, \hat{1}_t), \quad (2.9a)$$

$$\hat{1}_{\text{space}} = \text{Diag.}\,(1.001, 1.001, 1.001), \quad \hat{1}_{\text{time}} = 0.9980. \quad (2.9b)$$

Since invariants have the structure (Sections II-6.5)

$$\text{Invariants} = (\text{Length})^2 \times (\text{Unit})^2, \quad (2.10)$$

it is evident that the increase (decrease) of a unit implies the decrease (increase) of the related length.

As an incidental note, the above features have stimulated the formulation of the so-called *geometrical propulsion*, in which objects can move following a local change of the geometry without the application of any force visible to the outside, thus permitting arbitrary speeds for an outside observer (see Vol. II of monographs [3e] for brevity).

Rather remarkably, *features 1) to 7) are verified by all subsequent experiments*, as we shall see.

A few comments are now in order. I should first indicate that the measurements by Grossman *et al.* [15b] have been the subject of rather severe criticisms. To begin, the experimenters have made the *theoretical* assumption in the data elaboration of a frame in which there is no CP violation, in which case it is known that there cannot be Minkowskian anomalies, as shown by D. Y. Kim [13c] and others. Moreover, the statistics of tests [15b] are insufficient for any conclusion, whether in favor or against orthodox doctrines. Additional flaws of tests [15b] have been identified by Yu. Arestov *et al.* [15d].

I would like also to stress that *the deviations from the Minkowskian geometry do not constitute a violation of the fundamental Lorentz symmetry and of Einstein's special relativity.* This is due to the fact that the isotopies reconstruct the Lorentz symmetry and special relativity as being *exact in isominkowskian space*, as reviewed in Section II-6.5.

This comment is recommendable because of erroneous beliefs in the literature due to lack of technical knowledge of the isospecial relativity, *e.g.*, the claim by H. B. Nielsen and I. Picek that their parameter α characterizes a "violation" of the Lorentz symmetry [12].

For instance, it is easy to see that *the maximal causal speed in isospace is* c_0 *and not* c. This is due to the fact that the lifting of the speed of light $c_0^2 \to c^2 = c_0^2/n_4^2$ occurs jointly with the *inverse* lifting of the unit $1 \to n^*_4{}^2$. In view of invariant (2.10), it is then evident that the maximal causal speed in isospace remains c_0. The *exact* reconstruction of *all* other features of special relativity then follows [9c].

In short, rather than violating special relativity, *the mathematical, theoretical and experimental studies presented in these papers extend the applicability of the special relativity from the vacuum to universal conditions.* A *necessary* requirement to achieve this result is the use of the isomathematics.

The reader should also be aware that the exact fits of Figures 2 and 3 were simply unavoidable, due to the direct universality of Santilli's isominkowskian geometry for the representation of all infinitely possible, signature preserving deviations from the Minkowskian form.

Finally, I would like to mention that numerous other deformations of the Minkowski spacetime exist in the literature, *e.g.*, papers [17]. Besides lacking a direct experimental verification comparable to the above ones, these models are afflicted by the catastrophic physical inconsistencies of Section II-4.

2.6. Experimental Verification Via Data on the Bose-Einstein Correlation

The fundamental assumption of hadronic mechanics is that strong interactions have a *nonlocal* component of contact, thus nonpotential type due to deep wave-overlappings which, as such, has to be represented with anything *except* the Hamiltonian (to prevent granting potential energy to interactions that have none, a rather common nonsense in the orthodox physics, because the latter can only represent reality with H).

The most fundamental experiments are, therefore, those testing directly the nonlocality of the strong interactions.

Among them, the most important tests are those on the *Bose-Einstein correlation* in which: A) protons and antiprotons are made to collide at very big or very small energies; B) in so doing they annihilate each other in a region called the *fireball* and then decay into a large variety of unstable particles; and C) the latter decay in various modes whose final stages are given by correlated mesons (*i.e.*, very loosely speaking, mesons which are "in phase" despite the large mutual distances).

It is well-known in the literature that *the Bose-Einstein correlation cannot occur for purely local theories*, that is, theories dealing with a finite set of isolated point-like particles.

Lesser known in general (although well-known to experts in the

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field as I can testify) is the fact that *the notion of correlation violates the axiom of expectation values of quantum mechanics.*

For initial $|a_k>$ and final $|b_k>$ multi-states, said axiom can only yield *diagonal* expressions of the type

$$< A > = < a_k \,|\times A \times|\, b_k > \times \; = \; \sum_k a_k \times A_{kk} \times b_k, \qquad (2.11)$$

evidently because the quantity A, to be observable, must be Hermitean, thus diagonal.

On the contrary, a scientific representation of the Bose-Einstein correlation, requires *off-diagonal terms* mixing $<a_i|$ with $|b_j>$, $i \neq j$, which are evidently impossible for quantum mechanics.

In summary, the Bose-Einstein correlation is conceptually, technically, and (as we shall see shortly) experimentally outside the axioms of quantum mechanics.

Despite that, the literature in the Bose-Einstein correlations continues to claim "verification" of relativistic quantum mechanics (see, *e.g.*, review [18a] and numerous papers quoted therein). This is achieved via manipulations of the equations (also adopted in similar manipulatory cases) via: a) the introduction of all needed parameters of unknown origin; b) using these parameters to fit the experimental data; and c) then claiming verification of the theory.

As a specific example, it is easy to prove that, under the exact validity of relativistic quantum mechanics (including its crucial axiom of expectation values), the quantity measured in the experiments (called the *two-particle correlation functions*) can only have the form

$$C_2 \; = \; N \times (\, 1 + e^{-r^2 \times Q^2}, \qquad (2.12)$$

where: r is the radius of the fireball, Q is the relative four momentum, and N is a constant restricted by severe renormalization conditions.

The point is that, as well-known, *expression (2.12) does not represent correctly the experimental data, thus confirming the insufficiency of relativistic quantum mechanics.*

To salvage their beloved theory, orthodox physicists then introduce as many unknown parameters λ_k (called *chaoticity parameters*) as needed to fit the experimental data, and modify the rigorous formula (2.12) into the manipulated form (see, *e.g.*, papers [18])

$$C_2 = N \, (1 + \lambda_1 \times e^{-r_1^2 \times Q} + \lambda_2 \times e^{-r_2^2 \times Q^2} + \lambda_3 \times e^{-r_3^2 \times Q^2} + \lambda_4 \times e^{-r_4^2 \times Q}) \qquad (2.13)$$

It is evident that, under these manipulations, formula (2.13) does fit the experimental data. However, the claim that in so doing quantum mechanics is verified is scientific deception. In fact, the parameters λ_k are a measure precisely of the *deviation* of the Bose-Einstein correlation from the main axioms of the theory.

The first exact and invariant representation of the Bose-Einstein correlation via un-adulterated first axioms of relativistic hadronic mechanics was done in 1992 by R. M. Santilli in memoir [19a]. Due to the importance of the issue for new energies, a brief outline of the derivation appears recommendable.

First, the basic axiom of isoexpectation values, Equation (II-6.4.5), has been *conceived* for the Bose-Einstein correlation. In fact, it easily resolves the basic insufficiency of (2.11) with the broader structure

$$< \hat{A} > = < \hat{a} \,|\hat{\times}\, A \,\hat{\times}|\, \hat{b} > = < \hat{a}_i \,|\times \hat{T} \times A \times \hat{T} \times|\, \hat{b}_j > =$$

$$= \sum_{ijm} \hat{a}_i \times \hat{T}_{im} \times A_{mm} \times \hat{T}_{mj} \times \hat{b}_j \, , \qquad (2.14)$$

because, unlike observables, the isotopic element $\hat{T}$ can indeed be *nondiagonal*. This yields, by conception, all off-diagonal terms needed to represent the Bose-Einstein correlation from first axioms without ad hoc adulterations.

In memoir [19a] Santilli then uses isominkowskian space (2.2) characterized by the following isotopic element for the two-particle correlation function (Equation (8.10 of [19a])

$$\hat{T} \; = \; \text{Diag.} \, (b^*_1{}^2, b^*_2{}^2, b^*_3{}^2, b^*_4{}^2) \times$$

$$\times \begin{pmatrix} A & B \, [\, 1 \; - \; \exp[\int dx^4 \psi_{b2}(x)^\dagger \times \psi_{a1}(x)]] \\ C[1 - \exp[\int dx^4 \times \psi_{a2}(x)^\dagger \times \psi_{b1}(x)]] & D \end{pmatrix} \qquad (2.15)$$

where: $b^*_k{}^2 = 1/n^*_k{}^2$ represent the semiaxes of the fireball normalized to 1 for the vacuum; $b^*_4{}^2 = 1/n^*_4{}^2$ represents the density of the fireball also normalized to 1 for the vacuum), and the quantities A, B, C, D are restricted by the normalization Det. $\hat{T} = 1$, so that they have no impact on the fit.

As one can see, isotopic element (2.15) does indeed represent the overlapping of the wavepackets of particles 1 and 2 (via the integrals in the exponents). Also, the representation is such that, when the overlapping is null, the isotopic element becomes diagonal, and all correlations disappear. This confirms the *necessity* (rather than the validity alone) of the axiom of isoexpectation values.

After elaborations conducted in detail in memoir [19a], the final two-particle isocorrelation function derived from first axiomatic principles of relativistic hadronic mechanics has the structure (first derived in Equation (10.8), page 122 of [19a])

$$\hat{C}_2 = 1 + (K/3) \times \sum_\mu \hat{\eta}_{\mu\mu} \times e^{-q_t / b^*_\mu{}^2} = 1 + (K/3) \times (b^*_1{}^2 \times e^{-q_t / b^*_1{}^2} +$$

$$+ \, b^*_2{}^2 \times e^{-q_t / b^*_2{}^{2+}} + b^*_3{}^2 \times e^{-q_t / b^*_3{}^2} - b^*_4{}^2 \times e^{-q_t / b^*_4{}^2}) \qquad (2.16)$$

where q_t is the experimentally measured momentum transfer, under the isonormalization

$$K \; = \; b^*_1{}^2 \; + \; b^*_1{}^2 \; + \; b^*_3{}^2 = 3, \qquad (2.17)$$

and consequential upper and lower limits (Equation (10.26), page 127 of [19a])

$$\hat{C}_2^{Max} \; = \; 1 + 1/3 + 1/3 + 1/3 = 1.67, \quad \hat{C}_2^{Min} \; = \; 1. \quad (2.18)$$

Representation (2.16) also predicts the upper value of $n^*_4 = 1/b^*_4$ evidently for $\hat{C}_2^{Max} = 1.67$ (Equation (10.27), page 127 of [19a])

$$n^*_4{}^2 = 0.429, \qquad b^*_4{}^2 = 2.33, \qquad b^*_4 \; = \; 1.53 \, , \qquad (2.19)$$

thus implying again *local speeds in the interior of the fireball bigger than that of light in vacuum.*

Representation (2.16) also predicts that the fireball is a very prolate spheroidal ellipsoid with characteristic values (Equations (10.26), page 127 of [19a])

$$n^*_1 \; = \; n^*_2 < n^*_3{}^2, \; n^*_s = (n^*_1 + n^*_2 + n^*_3)/3 > n^*_4 < 1. \quad (2.20)$$

Finally, I should stress that, being constructed via an isotopic theory, representation (2.16) preserves the *exact validity of the Poincaré symmetry under nonlocal interactions*, although expressed as the covering Poincaré-Santilli isosymmetry [11,12].

It is rewarding for me to report that *the fit of the experimental data on the Bose-Einstein correlation at high energy with the data*

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of the UA1 experiments at CERN have confirmed the totality of the above predictions beyond my most optimistic expectations.

The fit was conducted by F. Cardone and R. Mignani (of the University of Rome, Italy), was first referred to me in 1992 via a private communication (Figure 4), and was then published in paper [19b] of 1996. The Cardone-Mignani fit provided the following numerical values of the characteristics constants for the p-$\bar{p}$ fireball

$$b^*_1 = 0.267 \pm 0.054,\ b^*_2 = 0.437 \pm 0.035, \qquad (2.21a)$$

$$b^*_3 = 1.661 \pm 0.021,\ b^*_4 = 1.653 \pm -0.015. \qquad (2.21b)$$

As one can see, *the fit of Figure 4 provides the fourth direct experimental verification of the isominkowskian geometry and relativistic hadronic mechanics, this time, in its most fundamental assumption, the historical legacy of the nonlocality of strong interactions.*

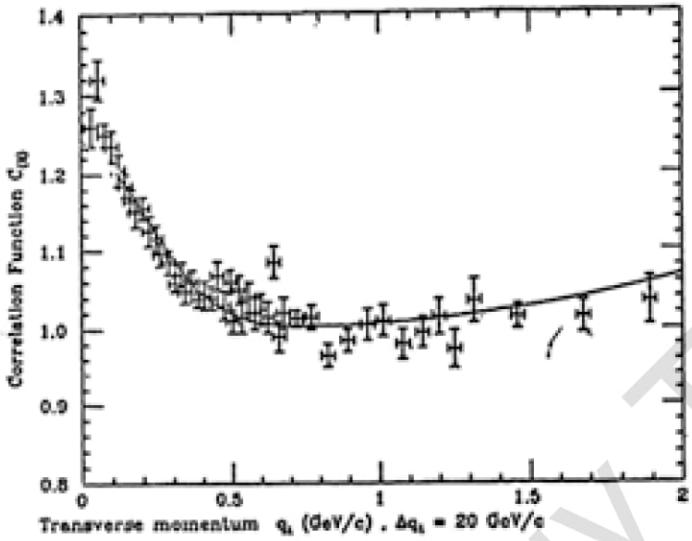

FIGURE 4: The exact fit of Santilli's two-point isocorrelation function (2.16) conducted by F. Cardone and R. Mignani (private communication of 1992 subsequently published in [19b]) via the experimental data on the Bose-Einstein correlation at high energy of the UA1 experiments at CERN.

The fit of Figure 4 also confirms all features 1)-7) of the preceding section.

I should mention that paper [19c] identifies the new upper limit of the isocorrelation function (2.16) (not treated in [19a])

$$C_2^{Max} = 1 + 1 + 1 + -1 = 3 \qquad (2.22)$$

thus permitting the theoretical representation of anomalous upper limits of the order of 3 detected in [18c] and other papers.

This constitutes additional, rather strong experimental support for the isominkowskian geometry and related relativistic hadronic mechanics because of the absolute impossibility for conventional quantum mechanics to reach such anomalous value.

Finally, numerical values (2.21) will soon result to be fundamental for the construction of a new structure model of neutron as a hadronic bound state of a proton and an electron.

The repetition of the study and related fit for the Bose-Einstein correlation of proton-antiproton at low energy (here omitted for brevity) confirms the above results (Figure 5).

It is evident that *the exact fit of Figure 5 provides the fifth direct experimental verification of the isominkowskian geometry and relativistic hadronic mechanics for the characterization of interior problems at large.*

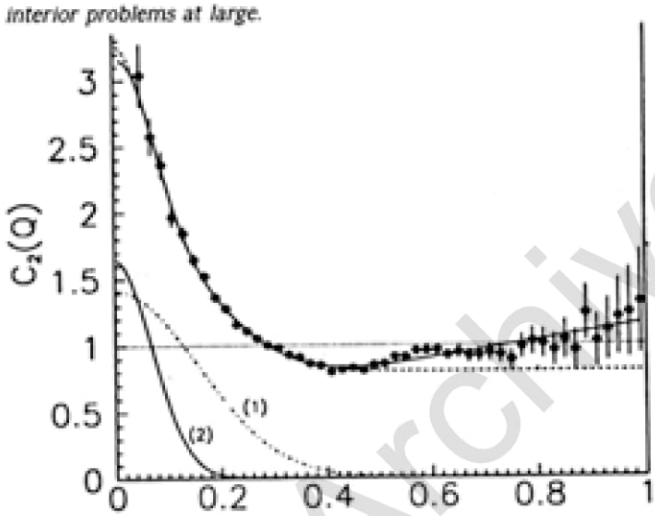

FIGURE 5: An illustration from [18c] of another exact fit of the Bose-Einstein correlation from first axiomatic principles, this time of the p-$\bar{p}$ annihilation at very low energies, which can be obtained via the exact Equation (2.16) of relativistic hadronic mechanics, rather than adulteration (2.13) of relativistic quantum mechanics.

In closing, I should point out that, unlike preceding papers listed in [II-22,II-24,III-16,III-25], and other papers, F. Cardone, M. Gasperini, and R. Mignani elected in papers [19b,19c] of 1996 and 1998 to abstain from quoting the preceding relativistic hadronic treatment [19a] of 1992, which was fully known to them, since Cardone and Mignani had provided its best fit in 1992 (Figure 4).

However, the main equations of [19b,19c] are *totally identical* to Equations (2.14) to (2.18) of [19a] even in the symbols, as the reader is encouraged to verify. Moreover, Cardone, Gasperini and Mignani elected to use in [19b,19c] a "deformed Minkowski space" which is *identical* to Santilli's space (2.2) even in the symbols, although without the quotation of its origination in [9b], as well-known to them as well as internationally.

To give the impression of novelty, in papers [19b,19c] Cardone, Gasperini and Mignani defined the formalism over ordinary fields, and elaborated the results via conventional functions and transform, by therefore abstaining from using the formulation of the original studies [9b,19a] via the full isomathematics (isofields, isospaces, isofunctions, etc.).

However, in so doing, *papers [19b,19c] are afflicted by the catastrophic inconsistencies of Section II-4 (lack of invariant units of measurements, absence of observables, lack of unique and invariant numerical results, violation of causality and probability laws, etc.) which are instead resolved ab initio by the prior unquoted studies [9b,19a].*

2.7. Experimental Verifications in Astrophysics and Cosmology

It is important for researchers in new energy to know that the isominkowskian geometry, isorelativistic mechanics, and isospecial relativity possess a number of additional verifications in fields other than particle physics.

Experimental verifications in nuclear physics, superconductivity, and chemistry will be outlined in the subsequent Papers IV and V. I would like to close this section with an indication of the experimental verifications in astrophysics and cosmology.

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One of the unsolved mysteries of contemporary astrophysics is the occurrence whereby certain quasars have a cosmological redshift dramatically bigger than their associated galaxies, despite the fact that quasars and galaxies result to be physically connected according to gamma spectroscopic evidence (Figure 6).

FIGURE 6: A view of: galaxy NCG 4316 (above) with redshift z = 0.0056; quasar Mark 205 (below) with dramatically bigger redshift z = 0.07; and the evidence of their physical connection provided by superimposed gamma spectroscopic plates.

The Einsteinian treatment of cosmological redshift necessarily requires its interpretation via motion away from us, resulting in the known expansion of the universe. However, the evidence that quasars and galaxies with dramatically different redshifts are physically connected, thus move with the *same* speed, evidently prevents any scientific representation via Einsteinian theories.

In 1991, R. M. Santilli [3d] proposed the simple explanation that the indicated difference in cosmological redshift is merely due to the *slow-down of the speed of light in the huge quasar chromospheres* (which can be as large as entire galaxies), similar to the slow-down of the speed of light in our atmosphere. As a result, *light exits said quasars chromospheres already redshifted.* A similar phenomena does not exist in the same magnitudes for a galaxy because their stars are isolated in space, and have dramatically smaller chromospheres. In this way, light from physically connected quasars and galaxies having the same speed can reach us with a dramatically different redshift.

The effect can be first read-off in the expansion of the Minkowskian redshift (for null aberration)

$$\omega = \omega_0 \times \frac{(1 - v/c_0)}{(1 - v^2/c_0^2)^{-1/2}} \sim \omega_0 \times (1 - v/c_0 + \tfrac{1}{2}(v/c_0)^2 + \ldots). \quad (2.23)$$

Since $v < c_0$, it evident that a *decrease* of c_0 will imply an *increase* of the redshift.

It was shown in [3d] that the above equation is insufficient to represent astrophysical evidence, *e.g.*, because chromospheres are *anisotropic and inhomogeneous*, while the geometry underlying law (2.23) is purely *isotropic and homogeneous*.

By using isominkowskian spaces (2.2), Santilli [*loc. cit.*] suggested the following *isodoppler law for the cosmological redshift* (as well as *blueshift*, see below)

$$\hat{\omega} = \omega_0 \frac{1 - (v/c_0)(n_4/n_s)\cos(\alpha\, b_s^2)}{[1 - v^k (1/n_k)^2 v^k / c_0 (1/n_4)^2 c_0]^{1/2}} \sim$$

$$\sim \omega_0 [1 - \beta(n_4/n_s) + \tfrac{1}{2}\beta^2 (n_4/n_s)^2 + \ldots] \quad (2.24)$$

which predicts an additional contribution in the redshift due to the anisotropy and inhomogeneity of quasar chromospheres.

In 1992, R. Mignani [16c] provided a verification of Santilli's isodoppler law by identifying the following parameters of most coupled quasars-galaxies (Figure 7).

$$K^* = \frac{b^*_s}{b^*_4} = \frac{(\Delta\omega + 1)^2 - 1}{(\Delta\omega + 1)^2 + 1} \times \frac{(\Delta\hat{\omega} + 1)^2 - 1}{(\Delta\hat{\omega} + 1)^2 + 1}, \quad (2.25)$$

where $\Delta\omega$ represents the measured Einsteinian redshift for galaxies, and $\Delta\hat{\omega}$ represents the isotopic redshift for quasars according to law (2.24).

GAL.	ω'_1	QUASAR	B	$\hat{\omega}_2$
NGC	0.018	UB1	31.91	0.91
BSOI		20.25	1.46	
NGC 470	0.009	68	87.98	1.88
68D	67.21		1.53	
NGC 1073	0.004	BSO1	198.94	1.94
		BSO2	109.98	0.60
		RSO	176.73	1.40
NGC 3842	0.020	QSO1	14.51	0.34
QSO2		29.75	0.95	
QSO3		41.85	2.20	
NGC 4319	0.0056	MARK205	12.14	0.07
NGC 3067	0.0049	3C232	82.17	0.53

FIGURE 7: A summary of Mignani's data [16c] verifying Santilli's isospecial relativity for cosmological redshifts of physically connected quasars and galaxies.

It is evident that the data of Figure 7 provide *the sixth experimental verification of the isominkowskian geometry and isospecial relativity.*

The seventh experimental confirmation is given by the quantitative-numerical representation [16d] of the internal red-, and blue-shift of quasars, which is permitted by the ω-dependence of the n's.

These studies predict that *one component* (but not all) of the tendency toward the red of Sunlight at Sunset and Sunrise is precisely of isotopic origin. In fact, at Sunset the Earth's rotation simulated precisely motion away from the source. This results in a *necessary* redshift in an amount which is measurable with current technology (see [3d] for brevity).

The prediction recommended for verification (see below) is the existence of an additional measurable component of redshift at Sunset due to the anisotropy and inhomogeneity of our atmosphere. The visibly bigger redshift at Sunset as compared to that at Sunrise is then due to the rotation of Earth, which increases the redshift at Subset, while decreasing it at Sunrise.

Numerous additional applications and experimental verifications of the isospecial relativity exist in astrophysics and

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cosmology, such as the elimination of the need for the "missing mass"

A study conducted in [16e] has revealed that the conjecture of the "missing mass" is due to the rather simplistic belief that the density of the universe is that of the vacuum. In this case the average index of refraction of the universe is $n^*_4 = 1/b^*_4 = 1$, the average speed is c_o, and the total energy of the universe is $E_{tot} = m_{tot} \times c_o^2$, which is grossly insufficient to represent various experimental data.

However, incontrovertible evidence establishes that *the average density of the universe is bigger than that of vacuum*, evidently because of the large number of galaxies and quasars. Moreover, all experimental evidence outlined in this section establishes that the average index of refraction of the universe $n^*_4 = 1/b^*_4$ is *bigger than one*, because of the hyperdense media in the interior of stars and quasars.

Isospecial relativity therefore computes the total energy of the universe according to Isopostulate II-V of Section II-7, $\hat{E}_{tot} = m_{tot} \times c^2 = m_{tot} \times c_o^2 / n^{*2}_4 = m_{tot} \times c_o^2 \times b^{*2}_4 > E_{tot}$. The "missing mass" is then merely due to the difference of the two values, "missing mass" = $m_{tot} \times (b^{*2}_4 - 1)$.

Equally intriguing is the new cosmology permitted by the isospecial relativity [16e] (called *isoselfdual cosmology* for certain technical reasons), under the condition of equal amounts of matter and antimatter in the universe, which implies that the universe has identically null total values of time, energy, angular momentum, etc. (because the values for matter are equal and opposite to those for antimatter), thus having no discontinuity at the time of creation.

The new isoselfdual cosmology therefore permits, apparently for the first time, *quantitative mathematical studies of the act of creation*, which are not evidently possible for the "big bang" and other cosmologies due to their singularities.

For brevity, I refer the interested reader to the specialized literature for these and other verifications of the isospecial relativity in astrophysics and cosmology.

Needless to say, numerous additional experimental verifications are recommendable, among which I mention:

Proposed experiment 1: Measure the isoredshift of Sun light at Sunset and Sunrise. The proposal consists of: a) identifying a number of Fraunhofer lines in the Sun light at the Zenith and then follow them to the horizon; b) measuring the same lines at Sunrise and then follow them to the Zenith; and 3) comparing the two measurements (additional tests are suggested in [3d]). As indicated earlier, isospecial relativity predicts a specific numerical value of measurement a) bigger than that due to the Earth's rotation, as well as bigger than measurement b) [3d]. This test would establish the very pillar of the isospecial relativity, the anomalies due to the inhomogeneity and anisotropy of physical media (which are completely absent in special relativity). The test would also resolve on Earth the mystery of physically connected quasars and galaxies with dramatically different redshift.

Proposed experiment 2: Establish the prediction of hadronic mechanics that photons emitted from the interior of hadrons are isoblueshifted. This test can be done in a number of ways available on request, and it is a necessary complement of the preceding one.

Proposed experiment 3: Provide a final resolution of the behavior of the meanlives of unstable hadrons with speed (or energy). The proposal essentially consists in the finalization of tests [15a,15b] without equivocal theoretical assumptions in the data elaboration indicated in Section 2.5. It is unreassuring to note that, after one century of investigations, and the use of billions of dollars of public funds, the experimental finalization of deviations from Einsteinian doctrines in the interior of hadrons (as well as nuclei and media at large) has not been conducted, and Einsteinian doctrines continue to be assumed as exact in the conditions considered, despite large evidence to the contrary. By keeping in mind that so many other, dramatically less significant experiments have been preferred by experimentalists, the above scenario leads to a *pre-meditated intent* to suppress the final veritication of deviations from Einsteinian doctrines in the interior of hadrons for evident personal gains (see in [1-2a] the report of countless solicitations I made to Fermilab, CERN and other laboratories to conduct the test here proposed, and its documentation in [1-2b]). I have no doubt that the occurrence will constitute the biggest condemnation that future historians may have for orthodox physicists of this century. In fact, the final experimental confirmation of deviations from Einsteinian doctrines in the interior of hadrons, nuclei, stars, and physical media at large, constitutes the most solid foundation for new clean energies so much needed by our society. The same confirmation will also stimulate a new scientific renaissance beyond the now surpassed Einsteinian doctrines, with implications and applications (such as geometric locomotion, antigravity for antimatter in the field of matter, causal spacetime machine, and others [3]) which can be only imagined at this time.

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References

1. R. M. Santilli, *Infinite Energy* **4**, No. 22, 33 (1998) [1a]; *Infinite Energy* **4**, No. 23, 69 (1999) [1b]; *Infinite Energy* in press (1999) [1c].

2. Toups Technology Licensing http://www.toupstech.com

3. R. M. Santilli, *Hadronic J.* 1, 574 (1978 P[3a]; *Foundations of Theoretical Mechanics*, Vol. I (1978), and II (1983), Springer-Verlag, Heidelberg/New York [3b]; *Lie-Admissible Approach to the Hadronic Structure*, Vol. I (1978) and II (1982), Hadronic Press [3c]; *Isotopic Generalization of Galilei and Einstein's Relativities*, Volumes I and II, Hadronic Press (1991) [3d]; *Elements of Hadronic Mechanics*, 2nd edition, Volumes I (1995), II (1995) and III (to appear), Ukraine Academy of Sciences, Kiev [3e]; *Isotopic, Genotopic and Hyperstructural Methods in Theoretical Biology*, Ukraine Academy of Sciences, Kiev (1997) [3f].

4. H. Georgi, *Lie Algebras in Particle Physics*, Benjamin/Cummings, Reading, Massachusetts (1982) [4a]. M. Kaku, *Quantum Field Theory*, Oxford University Press (1993) [4b].

5. A. Lorentz, *Versuch einer Theorie der Elektrishen und Magnetishen Erscheinungen in Bewenglen Korpern*, Leyda (1895) [5a]. W Pauli, *Theory of Relativity*, Pergamon Press, New York (1958) [5b].

6. M. Barone and F Selleri, Editors, *Frontiers of Fundamental Physics*, Plenum, New York (1995) [6a]. R. M. Santilli, *Lett. Nuovo Cimento* **33**, 145 (1982) [7b]. V. de Sabbata and M. Gasperini, *Lett. Nuovo Cimento* **34**, 337 (1982) [7c].

7 F Mirabel and F Rodriguez, *Nature* **371**, 464 (1994) [7a]. J. Tingay *et al.*, *Nature* **374**, 141 (1995) [7b]. D. Baylin *et al.*, IAU Comm. 6173 (1995) [7c]. P Saari and K. Reivelt, *Phys. Rev. Letters* in press [7d].

8. A. Enders and G. Nimtz, *J. Phys. France* **2**, 1693 (1992) [8a]. G. Nimtz and W Heitmann, *Progr. Quantum Electr.* **21**, 81 (1997) [8b]. E. Recami and R. M. Santilli, *Hadronic Journal*, in press [8c].

9. H. Minkowski, *Nachr. Ges. Wiss. Goettingen* **43**, 1908 [9a]. R. M. Santilli, *Lett. Nuovo Cimento* **37**, 545 (1983) [9b]; *Intern. J. Modern Phys. D* **7**, 351 (1998) [9c]; *Modern Phys. Letters* **13**, 327 (1998) [9d];

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Intern. J. Modern Phys. A **13**, 327 (1998) [9e].
10. R. M. Santilli, *J. Moscow Phys. Soc.* **3**, 255 (1993) [10a].
11. J. V Kadeisvili, *Math. Methods in Applied Sciences* **19**, 1349 (1996) [11a]. J. V. Kadeisvili, *Santilli's Isotopies of Contemporary Algebras, Geometries and Relativities*, Ukraine Academy of Sciences, Kiev, 2nd edition (1995) [12b]. Gr. Tsagas and D. Sourlas, *Mathematical Foundations of the Lie-Santilli Theory*, Ukraine Academy of Sciences, Kiev (1993) [11c].
12. H. B. Nielsen and I. Picek, *Nucl. Phys. B* **211** 269 (1983).
13. D. I. Blochintsev, *Phys. Rev. Lett.* **12**, 272 (1964) [13a]. L. B. Redei, *Phys.Rev.* **145**, 999 (1966) [13b]. D. Y. Kim, *Hadronic J.* 1, 1343 (1978) [13c].
14. A. K. Aringazin, *Hadronic J.* **12** 71 (1989) [14a]. A. K. Aringazin *et al.*, in *Frontiers of Fundamental Physics*, M. Barone and F Selleri, Editors, Plenum, New York (1995) [14b].
15. S. H. Aronson *et al.*, *Phys. Rev. D* **28**, 495 (1983) [15a]. N. Grossman *et al.*, *Phys. Rev. Lett.* **59**, 18 (1987) [15b]. G. Alexander *et al.*, *Phys. Lett. B* **368**, 244 (1996) [15c]. Yu Arestov *et al.*, *Found. Phys. Letters* **11**, 483 (1998) [15d].
16. F Cardone *et al.*, *J. Phys G.* **18**, L61 (1992) [16a]. F Cardone *et al.*, *J. Phys. G.* **18**, L141 (1992) [16b]. R. Mignani, *Physics Essay* **5**, 531 (1992) [16c]. R. M. Santilli, in *Frontiers of Fundamental Physics*, M. Barone and F Selleri, Editors, Plenum, New York (1995) [16d]. R. M. Santilli in *Modern Proceedings of the International Meeting on Modified Theories of Gravitation and Cosmology*, Beer Sheva, Ben Gurion University, Israel, June 1997), E. I. Guendelman, Edito, in press [16e].
17. J. Lukierski *et al.*, *Phys. Lett. B* **313**, 357 (1993) [17a]. J. Lukierski *et al.*, *Phys. Lett. B* **329**, 189 1994) [17b]. S. Majid *et al.*, *Phys. Lett. B* **334**, 348 (1994) [17c].
18. 171.B. Lörstad, Int. J. Mod. Phys. **A4**, 2861 (1989) [18a]. D. H. Boal *et al. Rev. Mod. Phys.* **62**, 553 (1990) [18b]. R. Adler et al., Z. Phys. C **63**, 541 (1994) [18c]. M. Gaspero *et al.*, *Phys. Lett. B* **588**, 861 (1995) [18d].
19. E. M. Santilli, *Hadronic J.* **15**, 1 and 81 (1992) [19a]. F Cardone and R. Mignani, *JETP* **83**, 435 (1996) [19b]. F Cardone, M. Gasperini and R. Mignani *Euop. Phys. J. C* **4**, 705 (1998) [19c].

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Speakers

Thursday, April 29, 1999

Ken Shoulders, "Charge Clusters in Action" (Somerset Power Corp.) Micron-sized clusters of electrons perform a low-energy phase transformation when interacting with solid material, propelling the electrons to high velocity without conventional heating. Fractional electron charge conversion seems to be responsible for the new energetics described.

Dr. Paul Brown, "Betavoltaic Batteries" (Nuclear Solutions, LLC) Nuclear battery that converts energy from a beta (electron) emitting radioactive source, such as tritium, into electrical power. The application of tritiated amorphous silicon as an intrinsic energy conversion semiconductor for betavoltaic devices is presented.

Kent Robertson, "The Coming Energy Revolution from Wind" (American Wind Energy Association) The wind energy industry has demonstrated extraordinary growth in the past year. Who is getting most of this power? Will wind energy displace fossil fuel generated electricity?

David Wallman, "Carbon-Arc Gasification of Biomass Solutions" Forced, rapid oxidation via carbon-arc gasification of biomass solutions, releasing a unique hydrogen-based gas, COH_2, with properties of a stable, versatile, clean fuel. Demonstration.

Chip Ransford, "Electric Power from Excess Heat" (NOVA Resources Group, Inc.) Fail-safe, fully contained and shielded laboratory electrolysis reactor, with a high pressure core, has been designed for a facilitating excess heat release. A table-top transmutation experiment is also shown.

Dr. Peter Graneau, "Release of Chemical Bond Energy" (Northeastern University Center for EM Research) Process using electrodynamic Ampere forces to trigger the release of chemical bond energy (latent heat of evaporation) from water, causing a cold fog explosion at 150% efficiency. It may be possible that fossil fuel burning could be replaced with a water arc process.

Thomas Valone, MA, PE, "Understanding Zero Point Energy" (Integrity Research Institute) *Science* in 1997 called it the "ultimate quantum free lunch." Now the experiments and theory are starting to reveal the vast potential energy which ZPE stores in its particle fluctuations. Slide presentation with the basic physics, details of the first ZPE patent, headline articles, and the experiments that have made ZPE something even the DOE and NASA are reconsidering.

Friday, April 30, 1999

Dr. David Goodwin, "Summary of the Breakthrough Physics Conference" (USDOE Office of High Energy and Nuclear Physics) Chairperson for the Space Science Technology and Applications International Forum (STAIF) Breakthrough Propulsion Physics Conference. Topics include zero point energy.

Bruce Perrault, "Radiant Energy Generator" Active Perrault valves, similar to Moray valves, utilize a pumping effect to siphon electrons from earth ground to be stored in high voltage capacitors. A second stage converts the HV charge to usable power et any frequency.

Dr. Steven Greer, "Evidence of Free Energy Suppression" There are some subjects that Stanford University has studied, endorsed, and encouraged further study by the public. The evidence of suppression and the magnitude of the technological advancement in certain sectors is very compelling.

Les Adam, "Magnet Power and Non-Combustive Helicopters" (AZ Industries) Magnetic fields improve fuel mileage by affecting hydrocarbon bond strength. Electric Pulse Drive Vehicles offer a new automobile design. Non-combustive helicopters utilize energetic decomposition of peroxide.

Dr. Edmund Storms, "New Method for Initiating Nuclear Reactions" (Los Alamos Labs) New method to initiate nuclear reactions within solid materials, so-called chemically assisted nuclear reactions, to generate energy without significant radiation. Presentation of groundbreaking field merging chemistry and nuclear physics.

James Griggs, "Hydrosonic Fluid Heater" (Hydro Dynamics, Inc.) Thermodynamically highly efficient device employs a cylindrical rotor with surface irregularities. Fluid injected into device exits with increased temperature and/or pressure. Cavitation-based with sonoluminesence.

Dr. Tom Van Flandern, "Complete Gravity Model and Free Energy" (Meta Research) Propagation of gravity has been experimentally shown to exceed speed of light. The LeSage interpretation of particle-gravity is clearly favored by new findings, suggesting that propulsion and gravitational shielding is possible.

Workshops

Saturday, May 1, 1999

Ken Shoulders, "Further Details on Charge Clusters in Motion, Q&A"
Dr. George Miley, "Low Energy Nuclear Reactions: Lattice Atoms"
Dr. Bob Bass, "Energy From MSD (Deuterium)"
David Wallman, "Biomass Solutions: Demonstration"
Paul Pantone, "GEET Clean Combustion Kit: Details and Technology"
Dr. Gene Mallove, "Assisted Nuclear Reactions: Cold Fusion"
Dr. Paul Brown, "Effective Radiation Waste PhotoRemediation Dramatically Shortens Half-Life With a Proven Technology"
Dr. Peter Graneau, "Experimental Results of Arc Discharge, Q&A"
Dr. Edmund Storms, "Evidence for Chemically Assisted Nuclear Reactions"
Jack Bitterly, "Flywheel Technology for Energy Storage"
Bob Rose, "Breakthrough Technology: Fuel Cells"
Les Adam, "Are We Ready for a New Energy World?"
Chip Ransford, "Demonstration of Carbon Arc Energy Source"
Dr. Steven Greer, "Evidence for Free Energy Technology Suppression, Q & A"

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Issue No. 2 **(56 pages)**

• Cold Fusion Goes Commercial: Clean Energy Technologies, Inc. (CETI) Aims to Help Clean Up the World • Fifth International Conference on Cold Fusion • Alchemy Nightmare: Skeptic Finds Heavy Element Transmutation in Cold Fusion Experiment • Magnetic Resonance Amplifier • Flowing Electrolyte Calorimetry • Moldova Water Fuel Device • Cold Fusion in 2001 and Beyond• Unitary Quantum Mechanics

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• Low Energy Transmutation Conference • Testing Excess Heat Cavitation Devices • Cold Fusion Companies and Products • Applying the Nucleon Cluster Model to Experimental Results • Table-top Sonoluminescence • How to Miss the Energy Boat • Book Review: *A Dialogue on Chemically-Induced Nuclear Effects* • Mechanisms of a Disobedient Science: A Cold Fusion Theory, Part I

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• Pons and Fleischmann Patent to Issue in Europe • Mizuno's Solid-State High Temperature Cold Fusion • 80-to-1 Cold Fusion Demo at Hot Fusion Meeting • Atomic Bomb Physicist (Dr. Joseph McKibben) Proposes Startling Cold Fusion Theory • The Piantelli Cold Fusion Patent • ICCF5 Talk by Los Alamos' Dr. Edmund Storms • Kawai Magnetic Motor • Acoustic Levitation • The New Scientific Age • Cold Fusion Documentary, "Too Close to the Sun," on BBC and Canadian TV

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